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Limitations of Milling in Metal Working.

BY JOHN RICHARDS.

Not only the unskilled but often the "office" people around a machine works wonder and say, "Why not use a number of tools and cut the iron away at once?"

The answer to this problem is not always ready, is not written in books, is hard to put into words even, but is well known to a practical man. It is thrust daily before his senses from the time he begins directing the action of tools. He knows why certain things can be milled faster and better than they can be planed, and as well knows that milling is in no way adapted for most of the flat and right line surfaces that have to be prepared.

The present purpose is to trace some of these conditions and limitations so far as they can be ascertained and are proved by common practice.

Milling is an intermittent cutting process in which the edges are in contact with the work, or in action, as the length of the cutting arc is to the whole perimeter of the cutter, commonly only a fraction of the whole time, and thus a cutting edge has opportunity to cool in this idle space of revolution. In direct or continuous cutting, hereinafter called planing, the movement is slower, because time must be allowed for conduction and escape of heat.

In planing, the material is removed by a cleaving wedge, in as large pieces as possible, to reduce the edge movement for a given amount of reduction. In milling, the material is cut into thin shavings and disintegrated, so to speak, which, in cutting nearly all kinds of material, requires power in proportion as the waste is comminuted or pulverized.

The cutting strains or deflection and disturbance of the work are in proportion to the length of the cutting edge acting at one time under like conditions, and in milling are such that in all kinds of flexible pieces it is a thicknessing and not a "truing" process, corresponding to planing boards on a surfacing or thicknessing machine compared to planing on a carriage machine for either wood or metal, where the surfaces acted upon take the form of the guiding ways.

The greater part of the plane surfaces in metal fitting require to be absolutely true in respect to alignment both ways, and the permissible strain upon the pieces limits the work to one tool and that so ground, set and operated as to produce no considerable transverse or other stress upon the work; also demands that clamps or holding devices be loosened up for a final cut, and in particular kinds of work the cuts must be taken from opposite sides successively.

There is nothing new in the wider use of milling tools now going on. It is correct and expedient for the purposes of duplication and has become possible with the homogeneous clean material now obtainable. This process has generally been applied as widely as its economic limits permit. Large machines with reversible teeth have been made for twenty years past and used for squaring off the ends of structural iron, beams and other sections, also for rough dressing footings for brackets and the like, when the work was not liable to flexure and a rough surface was not an objection. At Crewe, in England, the crank-slots in locomotive axles have been for twenty years past slotted out with huge milling tools that displaced about two pounds per minute. Messrs. William Muir & Co., of Manchester, England, twenty years ago carried heroic milling up to and beyond its economic limit with built up or multiple tools, for plane surfaces as well as for all kinds of profiles.

I am not speaking of milling irregular or small forms of clean soft metal, so successfully introduced in this country fifty years ago, at first in the manufacture of small arms and later on in sewing machines, watches and velocipedes, but to cases where the process can be compared to planing with one tool, not several tools, or even two, because one has all the required functions and need not be divided, that is, can be made of a shape and so set as to displace a section as great as the stability of the work will permit. No good workman has any use for two tools in a planing machine to work in series on the same cut. This, like the "multiple idea," is a conception of the "office" man.

Makers of machinery are the only mechanics whose business may include the manufacture of their own implements. Machine tools produce themselves, and while the art has touched sparingly upon scientific methods, in so far as implement making, no class of men are more on the alert than machine makers to shorten and cheapen their processes. Changes are sometimes tardy because of the expense of substituting old machine-tools, which are costly in the extreme compared to their product or earning power. Milling is an easy and simple expedient except as to making and maintaining cutters, and in this latter is another limitation that may be mentioned.

In the reduction of obdurate material of any kind, such as stone and hard metal, there is power consumed in proportion to the material cut away, and a certain amount of implement wear that goes to expense. In crushing quartz, for example, it requires about a pound of metal to crush a ton of quartz, varying with the nature of the material and metal. The dies can be made of cast or wrought iron, hard or soft steel, at 3 cents, or 20 cents a pound, and economy in crushing does not always demand the expensive material.

When rolled or forged iron was expected to have seams and "hard pins" of silica and castings chilled fins—sometimes "splash-spots" of chilled iron—the economy of tools required that they be renewable at a large grindstone in from one to three minutes' time. Tools costing from $3 to $10 a pound, renewable only by high skill and risk, have no place in such work.

The fact is that the substitution of milling for planing in machine work is a problem of better or cleaner material and duplication: the latter a sequence of organized manufacture, now so rapidly spreading in all branches of the metal working arts, and is adopted as fast as expediency permits. It is not a problem of one tool against a number of tools, as is sometimes represented. There is but little analogy in the manner of their operation and results that permits a comparison by numbers, and such a suggestion, which we sometimes hear, comes from those who have no practical experience in manipulative processes. The heroic treatment of metal, in what may be called cold processes, is a dream of the uninitiated. When in a heated or

plastic state it can be smashed, squeezed and forced into any form or at any rate the strength of implements will permit, but when cold all the conditions are changed. The more hurry the less speed is a rule of constant application. The "lightning machinist" described by a witty writer some years ago is a fair illustration of the case. He moved all day like a comet and in the evening was a little behind where he started in the morning.

That cold cutting implements have been wonderfully improved during late years goes without saying, and that reasonable advances will be made in future is to be expected, in part, no doubt, by rotary implements and multiple edges for the finer and coarser kinds of work where duplication is possible, also for profile cutting, but the single cutting tool has its permanent place and functions that there is neither hope nor promise of supplanting, by rotary tools at least. Any skilled mechanic can determine as soon as he sees a piece of work whether it can be successfully milled or not; also knows how to go about the work, and can estimate everything, except the risk of destroying cutters, and this must be guessed at.

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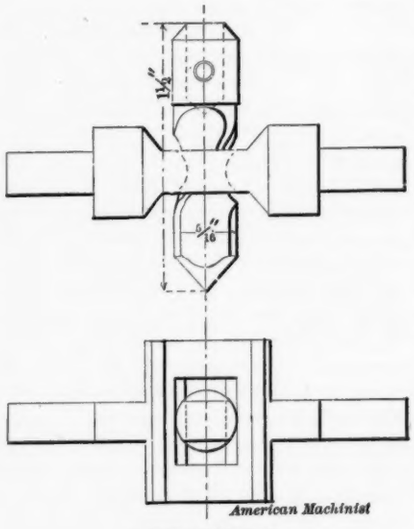
A Unique Manufacturing City.

Gloversville, N. Y., where I recently spent a little time, is a place of considerable interest. It is in many respects a peculiar place. While it is almost exclusively a manufacturing city, it is like no other city in the world. As its name asserts, its chief, and almost its entire, business is the manufacture of gloves, and these it makes for all the States of the Union and for other glove-wearing peoples. The city speaks for itself as a place of comfortable homes, without the display of great wealth on the one hand or of grinding poverty on the other. Its growth has been phenomenal, its population having increased sixfold in a third of a century. It is in a poor country and at a considerable elevation, but its business connection with the great world sustains a steam railroad and now also a trolley line. The repair shop of the railroad, to keep out of mischief, has done quite a business in second-hand locomotives, a great number having been picked out of the scrap heap and fixed up here for the bargain counter, and found ready sale. This business, however, does not seem to be flourishing at present, whether from a failure to connect at the buying or the selling end I am unable to say.

Though a busy and prosperous manufacturing city, the factories are not conspicuous, being apparently in a great many cases in the yard back of the house of the proprietor. This is possible from the fact that the manufacturer of gloves does not require heavy machinery, or, indeed, much machinery of any kind. So far as the machinist is concerned, the principal things with which he has to do are the making of cutting machines and the numerous cutters for them, and the repairing and making of parts for sewing machines. Quite a variety of sewing machines are used in glove work, including several with which the outside world is not familiar, and also several which are not made in the United States. The repairing of such a variety of machines, and in considerable numbers, has been the foundation upon which is developing at least one quite extensive and prosperous business, that of Curtin & Hebert, Mr. Frank Curtin, of the firm, being evidently one of the shop amateurs of whom Mr. Tecumseh Swift has discoursed to us a little lately, who work at the trade, not only for the love of it, but also for a reasonable pecuniary reward. The shop is well equipped with modern machine tools, and is now coming to the luxury of a tool room, a very peculiar luxury from the fact that it is not, as other luxuries, an expensive one, the expense being rather in the lack of it.



A MILLING JOB.

A great variety of parts of sewing machines are made here, and they are made in the modern, American way, with jigs, gages, standard sizes and general interchangeability. This is all right as far as the American machines are concerned, but with the foreign machines there is trouble at once. They are built under a different system. As the machines come here now, a dozen or so at a time, presumably of the same batch out of the factory, it is painfully impressed upon those who handle them that the parts are not interchangeable and must not be mixed. The machines also are so poorly made that they cannot be run at more than 600 turns per minute, while many American machines run above 2,000. This fact has been so impressed upon the firm that they have been preparing to manufacture one of these machines "made in Germany," and as it will be made according to the best American methods there can be no question as to the result.

The casting of the frame of the machine was an interesting job to begin with, and it is now successfully accomplished in Gloversville without any help from the outside world. Many other interesting operations are also provided for. Mr. Curtin showed me the piece of which I here give a sketch, suggesting that the readers of the "American Machinist" be asked to tell him how to make it, especially the twisted spindle. This spindle is vertical and carries a slim rod which runs up into the finger of a glove with a hook on the end which catches the loop from a horizontal needle, forming a chain stitch. The outer piece works up and down and causes a partial rotation, a little less than half a turn, of the spindle. There is first a straight, flat part, then the twist and a little straight above that. The two sides are alike. The straight and the twist will be all milled at a single operation, one side at a time, then turning half way round for the other side. The mill will be straight and a little less than a quarter of an inch in diameter and long enough to extend across the surface to be cut. The question is as to providing the proper feed and rotation. Mr. Curtin, I have no doubt, knows precisely how he is going to do it, but he is just the kind of fellow who would appreciate and be delighted with a better way of doing it. The dimensions on the sketch give a sufficient idea of the sizes of the pieces.

Gloversville has experienced some falling off of business on account of the war. People do not wear gloves as much when fighting, although one enterprising manufacturer, who happens also to be Member of Congress for the district, has an army contract for gauntlets for cavalrymen.

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A Tax on Exports of Machine Tools.

It is of course not to be believed that anyone who took part in the enactment or who now is concerned in the execution of our tariff law has thought of the possibility of this law operating as a tax upon exports of machine tools. Yet such is its effect so far as it has any direct effect whatever upon our American machine tool industry.

It is scarcely necessary to point out that, so far as direct protection is concerned, the American tool builder gets none whatever from the tariff. He could not, in fact, be protected. He goes into foreign countries and successfully competes with foreign builders on their own ground, after paying freight charges and whatever of import duties there may be imposed by those foreign countries. He fights and wins his own commercial bat-

tles, and is sometimes handicapped in a curious and unexpected way by the present tariff law.

It frequently happens that in the case of a machine more or less special in character, or where a standard machine is to be fitted with tools for certain work to be done by the foreign customer, it is thought best to submit the machine and tools to a thorough, practical working test before they leave the American machine shop in which they have been built.

Obviously the best way, and, in fact, sometimes the only way, in which such a test can be satisfactorily made is to get from the foreign customer some of his forgings or castings on which the machine is designed to operate. These, put into the machine and finished, or at least operated upon in the specified manner, not only serve to reveal any points that may have been overlooked and enable the fault to be corrected before shipment, but, returned with the machine, prove to the foreign buyer that the machine and tools have operated upon *his* material in the manner called for by the specifications or contract.

Complaints have reached us, both from home builders and their foreign representatives, that our custom house authorities were unreasonable in their treatment of these samples, and as a result of a circular letter of inquiry we found that a great many American tool builders had not only been required to pay considerable sums as import duties on these samples, but that the delay in getting them through the custom house was, in many cases, much more serious than the payment of duties, delaying the shipment of machines in some instances as much as two months.

With a view to seeing what might be done to remedy this difficulty, I called upon Assistant Secretary of the Treasury W. S. Howell, in Washington, and upon giving him an oral statement of the case he requested a written statement of it, saying that it interested him, that he would take it up personally and see what could be done in the premises.

This statement was subsequently mailed to him and is here printed with his reply:

APRIL 20, 1898.

Mr. W. B. Howell, Assistant Secretary of the Treasury, Washington, D. C.:

DEAR SIR—In accordance with your request growing out of our conversation the other day in your office I herein make the statement referred to.

You are probably familiar with the fact that during the last five years a very considerable proportion of the business done by American builders of machine tools has been in foreign countries; in some cases as much as 90 per cent. of the business of an American shop being done abroad. This business is a growing one and promises to be of increasing importance.

These American machine tools are being sold abroad in the face of adverse tariffs usually and upon their merits; it being considered generally by the foreign buyer that he is getting better value for his money that he can obtain from the makers of any other country.

As you will see, therefore, the American tariff is almost if not quite useless so far as protection of the American tool builder is concerned. He has to fight his own commercial battles, and it is of course the object of the Government to at least not throw obstacles in his way. This has been inadvertently done, however.

A considerable proportion of the American machine tools built for foreign buyers have been, either in whole or in part, special in their nature. That is to say, either an entire machine or some parts of it, or some of the tools intended to accompany it and to be used in it, are made with special reference to the particular work the machine is to do, which work may be and often is unique, *i. e.*, not done in precisely the same form in any establishment except the one for which this tool is constructed.

It often seems advisable about the time the machine is completed to set it up in the shop of its builder here and test it. This can best be done by bringing over from the foreign customer castings or forgings to be placed in the machine and operated upon, this being often the only means of testing the machine under the actual conditions it must subsequently work under.

These sample castings or forgings to be thus treated are returned with the machine as evidence that the machine has performed the work in a satisfactory manner, and such castings or forgings are scarcely if ever of any value for use here, being generally only a part of some machine or other structure usually not made here at all.

Our American tool builders find that when such samples are small enough to come through the mails they are simply treated as "samples of no value" and are delivered to them without delay and without the payment of duty, but when they are too large and heavy to be mailed and are sent by express it is then found that duty must be paid upon them, and what is worse in many cases there is a delay in delivery amounting in some instances to as much as two months.

This delay is not caused by any act of omission or commission chargeable to the Treasury Department so far as I can see; it is usually the fault of the international express companies; but when it occurs it grows out of the necessity for passing these samples through the custom house, the same as though they were articles imported for use. By inquiry I learn that this delay may be largely avoided by having these samples shipped to custom houses near the consignee, avoiding the New York custom house, but it seems to me that it would be very desirable if such articles could be classed as samples of no value, which they are in fact, and therefore admitted free of duty and without unnecessary delay, the duty upon such things being, in so far as it is collected, simply a tax upon exports of machinery, and in its effect nothing else.

I inclose herewith quotations from a number of letters received from American builders of machine tools bearing upon this subject, which letters are replies to a letter sent to each, a copy of which I also inclose.

Trusting the matter will receive your attention, I am,

Very truly yours,

FRED J. MILLER,
Editor.

Division of Customs, TREASURY DEP'T.,
Office of the Secretary,
314-I. WASHINGTON, D. C., May 25, 1898.

Mr. Fred J. Miller, Editor American Machinist, 256 Broadway, New York, N. Y.:

SIR—The department duly received your communication of April 20 last and referred the same for report to the collector of customs at New York.

I inclose a copy of his report, by which you will learn that the action of the collector and appraiser has been in accordance with the requirements of law. The appraiser states that there has been no unnecessary delay in his department in examining and reporting such articles, and if the invoice or order to appraise is in his possession and the goods are in the public store, the delay is generally not over twenty-four hours.

You should recognize the fact that every imported article must pass through the custom house before delivery, must be examined and appraised and, if dutiable, the duty must be collected. Articles coming through the mail are examined by the customs officer stationed at the post office and, if found to be of no commercial value, are delivered therefrom. Heavy articles must necessarily be sent to the appraiser for his examination. I have carefully considered the suggestion made by you that the articles imported for use in testing machinery be treated as samples of no commercial value, and have to advise you that there is no provision of law by which they could be admitted free as such, and the collector must be governed in each case by the appraiser's return. Should the appraiser declare the articles to have no commercial value, they will be delivered free; but in case that officer reports a dutiable value, duty must be exacted as provided in the tariff act.

The officers at New York state that every effort will be made to avoid undue delay, and the department will gladly cooperate with this object.

Respectfully yours,

W. B. HOWELL,
Assistant Secretary.

Mr. Howell inclosed copy of a letter, which reads as follows:

[COPY.]

OFFICE OF THE COLLECTOR OF CUSTOMS,
PORT OF NEW YORK, May 18, 1898.

Hon. Lyman J. Gage, Secretary of the Treasury, Washington, D. C.:

SIR—I have the honor to acknowledge the receipt by indorsement thereon, dated April 26, 1898 (J. M. C.), of the communication of Fred J. Miller, editor of the "American Machinist," dated April 20, 1898.

Mr. Miller complains of the exaction of duty as made by this office on castings or forgings that are imported from time to time, which castings or forgings are imported for the purpose of testing certain American made machinery in the factories of the manufacturers, for the purpose of seeing whether the machinery performs its proper functions; hence, the claim is made that these imported castings or forgings should be classified as samples, and therefore entitled to free entry, as samples.

There is no specific provision of law for the free entry of samples, and it appears from the report of the appraiser, dated May 13, 1898, that these castings or forgings oftentimes have a commercial value; hence, he is constrained, under the law, to appraise the merchandise and return its dutiable character to the collector for the purpose of assessing duty; that when they have no commercial value they are returned accordingly.

As to the following statement contained in Mr. Miller's letter—"This delay is not caused by any act of omission or commission chargeable to the Treasury Department (this office) so far as I can see, but is usually the fault of the international express companies; but when it occurs it grows out of the necessity for passing these samples through the custom house the same as though they were articles imported for use"—Mr. Miller should be informed that no imported merchandise, either free or dutiable, is delivered directly into the hands of importers without proper entrance and clearance through the custom house, as required by the statutes, and it appears from the report of the appraiser that there is no unnecessary delay in the appraisement and return of the merchandise to this office.

I return the communication of Mr. Miller and its accompanying inclosures.

Respectfully yours,

(Signed.) G. R. BIDWELL,
Collector.

It is thus made evident that though there are men connected with the customs department who would willingly do anything they could to obviate the difficulty they must of course be governed by the law.

In due time an effort will be made to secure the passage of a law removing this burden of an export tax on American machinery, but in the meantime we advise tool builders to direct that all such samples be sent under entry for immediate transportation to the designated port nearest their destination, in which case they will go through New York, or other first port of entry, without appraisement and will be appraised and duty collected at the designated interior port.

According to the law "importers at duly designated interior ports, who desire to make direct importations, may have merchandise (other than explosive articles) imported by them directly forwarded, without appraisement, from the port of first arrival, by making entry thereof at such port, under the provisions of the act of June 10, 1880, amended by the act of February 23, 1887."

The exterior ports from which merchandise can be forwarded are as follows:

Baltimore.....Md.	Ogdensburg.....N. Y.
Bangor.....Me.	Pensacola.....Fla.
Bath.....Me.	Philadelphia.....Pa.
Boston.....Mass.	Portland.....Me.
Charleston.....S. C.	Portland.....Ore.
Chicago.....Ill.	Port Huron.....Mich.
Cleveland.....Ohio	Port Townsend..Wash.
Detroit.....Mich.	Rochester.....N. Y.
Duluth.....Minn.	San Diego.....Cal.
Fernandina.....Fla.	San Francisco.....Cal.
Galveston.....Tex.	Sault Ste. Marie..Mich.
Key West.....Fla.	Savannah.....Ga.
Los Angeles.....Cal.	Seattle.....Wash.
Marquette.....Mich.	Sioux City.....Ia.
Mobile.....Ala.	Tacoma.....Wash.
Newport News.....Va.	Tampa.....Fla.
New Orleans.....La.	Toledo.....Ohio
New York.....N. Y.	Vanceboro.....Me.
Norfolk.....Va.	

Goods intended for immediate transportation must be consigned on the bill of lading in bond to (name the destined port). Consul's certified invoice in addition to bill of lading required at first port of arrival. Consul's certificate not required on goods valued less than $100. The privileges for such shipment shall extend to the following ports, to which merchandise may be transported, without appraisement, under the act of June 10, 1880:

Albany.....N. Y.	Newark.....N. J.
*Atlanta.....Ga.	New Haven.....Conn.
Baltimore.....Md.	New Orleans.....La.
*Bangor.....Me.	New York.....N. Y.
*Bath.....Me.	*Newport News....Va.
Boston.....Mass.	Norfolk.....Va.
Bridgeport.....Conn.	Oakland.....Cal.
Buffalo.....N. Y.	Ocala.....Fla.
Burlington.....Vt.	Ogdensburg.....N. Y.
Charleston.....S. C.	Omaha.....Neb.
Chicago.....Ill.	Philadelphia.....Pa.
Cincinnati.....Ohio	Pittsburg.....Pa.
Cleveland.....Ohio	*Portland.....Me.
Columbus.....Ohio	*Portland.....Ore.
Council Bluffs.....Ia.	Port Huron.....Mich.
Denver.....Col.	*Portsmouth.....N.H.
Des Moines.....Ia	*Port Townsend. Wash.
Detroit.....Mich.	Providence.....R. I.
*Dubuque.....Ia.	Pueblo.....Col.
*Duluth.....Minn.	Richmond.....Va.
Dunkirk.....N. Y.	Rochester.....N. Y.
Durango.....Col.	Rockville.....Conn.
*Enfield.....Conn.	Sandusky.....Ohio
Erie.....Pa.	*San Antonio.....Tex.
Evansville.....Ind.	*San Diego.....Cal.
Galveston.....Tex.	San Francisco.....Cal.
Grand Haven.....Mich.	*Sault Ste. Marie..Mich.
Grand Rapids....Mich.	Savannah.....Ga.
Hartford.....Conn.	Syracuse.....N. Y.
Indianapolis.....Ind.	*Seattle.....Wash.
*Jacksonville.....Fla.	*Sioux City.....Ia.
Kansas City.....Mo.	Springfield.....Mass.
*Key West.....Fla.	*St. Augustine.....Fla.
Leadville.....Col.	St. Joseph.....Mo.
Lincoln.....Neb.	St. Louis.....Mo.
*Los Angeles.....Cal.	St. Paul.....Minn.
Louisville.....Ky.	*Tacoma.....Wash.
*Marquette.....Mich.	*Tampa.....Fla.
Memphis.....Tenn.	Toledo.....Ohio
Middletown.....Conn.	*Vanceboro.....Me.
Milwaukee.....Wis.	Washington.....D. C.
Minneapolis.....Minn.	Wilmington.....Del.
*Mobile.....Ala.	*Wilmington.....N. C.
Nashville.....Tenn.	

The "Immediate Transportation" bonded lines referred to are as follows:

Adams Express Company.
American Express Company.
Baltimore & Ohio Railroad Company.
Central Vermont Railroad Company.
Chesapeake & Ohio Railroad Company.
Clyde Steamship Company.
Delaware, Lackawanna & Western Railroad Company.
Erie Railroad Company.
Lehigh Valley Railroad Company.
Merchants' Despatch Transportation Company.
Metropolitan Steamship Company.
New York, New Haven & Hartford Railroad Company.
New York, Ontario & Western Railroad Company.
Norwich & New York Transportation Company.
Ocean Steamship Company.
Old Dominion Steamship Company.
Pennsylvania Railroad Company.
Port Reading Railroad Company.
Southern Pacific Company.
Starin's City, River & Harbor Transportation Company.
United States Express Company.
Wells, Fargo & Co.
West Shore Railroad Company.

Examination, appraisement and assessment by the New York customs authorities may be avoided by observing the above directions, and this is very desirable.

At a port receiving the bulk of all importations, and where the affairs of very large and regular importers must be attended to, the machinery is lacking for facilitating the importation of small consignments, which are evidently often overlooked and neglected, if not by the custom house itself, then by the express companies.

Besides the present appraiser at the port of New York is, we should judge, not a man who would be disposed to give full weight to the representations of a machine builder regarding the actual commercial value of such samples. Appraisers at the interior points named would probably be more favorably disposed, especially where they personally know of the standing and reliability of the firms to whom the samples are consigned. Of course everyone informed in

* Consult Immediate Transportation Bonded Lines before making entries.

such matters knows that regardless of their value in the country where they are produced these samples can usually have no commercial value whatever here, but to make a customs appraiser understand this and why it is so would probably not usually be an easy thing to do. One firm reports that they have found it practically impossible to avoid payment of full duties on their own (small) tools which have been sent abroad and are for any reason returned for alteration, repairs or to be replaced on account of alleged defects.

As stated above, an effort will be made to have a law enacted relieving tool builders of this handicap on their foreign business, but in the meantime the thing to be done is to avoid having goods pass through the New York custom house, and this can be done in the way pointed out above. F. J. M.

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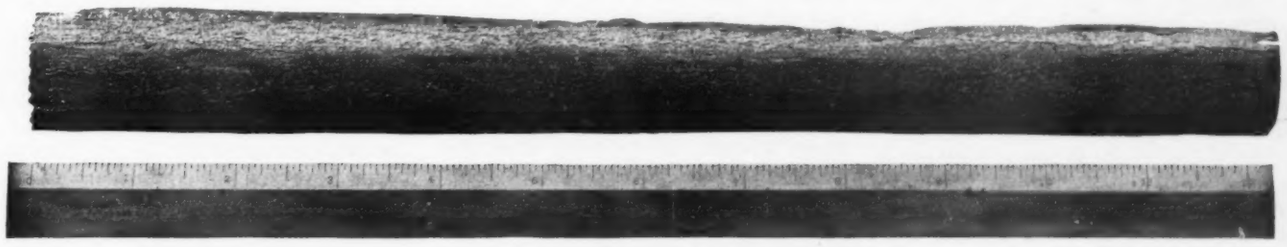
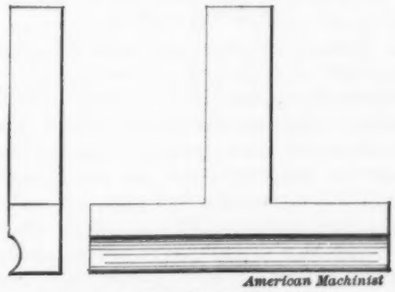
A Broad Feed Finishing Cut—A Planer Chip.

We have been illustrating from time to time planer and lathe chips that seemed particularly interesting, and we give a view herewith of a chip taken by a planer tool. The feed in this case was 12¼ inches, and that, therefore, is the width of the chip, and consequently we have been compelled to reduce the engraving somewhat in order to get it onto our page. The 12-inch graduated rule photographed with it gives, however, a graphic idea of its size. The chip is cast iron, and was taken in making a finishing cut on the bed-plate of a pumping engine at the Snow Steam Pump Works, Buffalo, N. Y. The chip is not exceptional for that job in that shop, but represents regular practice, and we give herewith also a sketch of the tool with which, not this particular chip, but similar chips are taken. The tool shown is the style adopted where the feed is relatively fine—say, 2 to 4 or 5 inches—but for broad feeds—5 to 12 inches or over—the tool is made as a blade simply, which is held in a holder. It is hollowed out on the front face, as shown, in order to get a *cutting* action and so that the chip is not crushed or jammed off. The cutting edge must, of course, be straight, and to secure this there is, in the tool room, a special fixture for grinding it. The chip shown is 12¼ inches wide, which is ¼ inch less than the width of the tool. The surface left by this tool is a very good one. There are no signs of chattering as, of course, is proven by the fact that the chip is rolled up, as shown. The planer is 72 inches square, with a 20 foot bed. The superintendent of the shop is Mr. J. H. B. Bryan, an ex I. P. Morris and Walker Manufacturing Company man, and therefore accustomed to heavy work, though we do not understand that he has until recently succeeded in taking finishing cuts at the rate mentioned. We consider this a remarkable performance—speaking eloquently for the rigidity and power of the modern planer. It is to be borne in mind, however, that probably no planer ever built would take such a cut smoothly, using a tool without top rake and simply jamming the chip off, instead of cutting.



CAST IRON CHIP 12½ INCHES WIDE—FINISHING CUT ON A PLANER.



A PLANER FINISHING TOOL.

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Patents—III.*

BY JAMES W. SEE.

MODIFICATIONS.

It frequently happens that an inventor, in applying for his patent, can show the preferred structure and lay the foundation for broad claims, while at the same time he can see various modifications capable of the sames results. In such case the inventor is often desirous of illustrating such modifications in his patent, and patent solicitors often yield to the desire. It is generally unwise to illustrate and describe modifications. The claims should be of scope to cover the invention and mere modifications of it, regardless of whether these modifications are or are not set forth, and regardless of whether the inventor has conceived of them, so long as they are mere modifications. If he does show modifications, he might in court run up against a rule of law that where there is an enumeration the matter is limited to the enumeration. An infringement might employ a mere modification not comprehended by the enumeration. Again, it is a maxim of law that a mere modification is comprehended by a claim. When the patent is taken into court, it might happen that some enumerated modification might be found to be old in the prior art, and in such case the claim would fall. If no modification was shown in the patent, then the patentee would be at liberty to deny that the given old device was a modification covered by his claim, thus possibly having his patent maintained for the structure shown in it. If the old modification was set forth, then the patentee could not deny that it was a mere modification of his invention, and that his so-called invention was a mere modification of the old device. Therefore, set forth only the preferred form of the invention, and depend on the scope of the claims.

DIVISIONAL PATENTS.

It may not be possible to cover the several segregable features of a given machine in a single patent. The law contemplates a patent for an invention and not for a number of inventions, and the classification of inventions in the Patent Office, and the organization of the examining bureaus, largely control in determining the matter of divisional applications. A bicycle may be invented which is new and patentable viewed as a whole structure. In such case the claim would recite all of the elements essentially involved in the new organization. But in this bicycle the pneumatic tire may of itself be new and patentable, and the wheel may be of a novel construction, and the lock-nut may be new, and the driving chain may be new, and there may be a new means for securing the joints of the tubing. These matters cannot be covered in one patent. The improved tire would be viewed as being entirely independent of the peculiarity of the bicycle, and would be susceptible of employment on other kinds of bicycles or vehicles; the wheel construction might be employed in other kinds of bicycles or in wheelbarrows; the chain might be employed in varying situations calling for the use of driving chains. In the Patent

*Presented at the Niagara Falls meeting of the American Society of Mechanical Engineers.

Office the wheel of a bicycle is not treated as a bicycle wheel but as a wheel, for any purpose for which it may be suited. A bicycle chain is not called a bicycle chain, and applications for patents on chains are not examined by the examiner who examines bicycle applications. Lock-nuts constitute a sub-class by themselves. The fact that the arts have recognized these that the arts have recognized these separate sub-classes of devices, and that the Patent Office classification of inventions deals with them as separate and independent elements in the arts, and that the examining divisons of the Patent Office deal exclusively with given matters, all these facts go to the merit of the question of division of application The single patent can cover only such matters as are necessarily interrelated to each other. The patent on the bicycle can cover the improved lock-nut in its combination relationship to other features of the bicycle, but it cannot contain a claim covering the lock-nut by itself. The lines of divison in the Patent Office are reasonable and necessary lines, and questions of doubt will, on review, generally be resolved in favor of the applicant. If the applicant can afford it he would be wise to resolve these doubts in favor of separate applications.

SOLICITORS.

Solicitors' fees cover the extended conferences or voluminous correspondence with the inventor; the preparation of the application; the prosecution of it in the Patent Office; the guarding of the inventor's interest in securing all that he is entitled to, and the delivery of the patent. The work is not to be measured by the complexity or simplicity of the invention. An improvement in carpet tacks might involve very much more legal work than an improvement in locomotives. The money value of an invention is often determinable by the merit of the patent granted upon it, and care should be used not to destroy the value of the property at the very start by getting the patent as cheaply as possible. The inventor sees but little of the actual work done by the patent solicitor, the real work being done generally after the application is filed in the Patent Office. It is then that the battle takes place, and it is then that the inventor's property is to be made good or bad. It does not follow that the highest priced service is the best, but it is not likely that the best or even good service will be found at low price.

The selection of a solicitor by an inventor is often to be controlled by the character of the invention. Thus a given invention may call for peculiar mechanical skill on the part of the solicitor. Most all solicitors will be found competent to grasp most mechanical inventions, but a case occasionally arises where extraordinary mechanical skill is required in drawing distinctions between the new invention and its predecessor, the procuration of the patent thus depending very largely upon mechanical skill on the part of the solicitor. In such a case select a solicitor skilled in mechanics, or in the special branch of mechanics involved in the invention. Another invention may be simple in its device, but the question of obtaining the patent may depend entirely upon fine spun legal considerations. In such case the solicitor brilliant in the law and dull in mechanics might be the better man. Again, the brilliant mechanic and lawyer might be less preferable than a less talented solicitor in connection with a chemical case. Again, it is always desirable in important cases to have solicitors who have had experience in the particular line in question. Thus, for instance, if one has an important and complicated invention in textile machinery he would be wise to have a New England solicitor, or one who has had New England experience, for that section is the home of textile arts of this country, and the solicitors of that section have had much more experience than those of other sections. In metallurgy, and in machinery of the soil and harvest, the most competent solicitors would most likely be found in other sections. For general purposes, however, it may be stated, that the competent solicitor can quickly get within his grasp the salient points of most any invention. If he has had proper training and experience the inventor will often be astonished at his capacity for tearing an invention into pieces, sifting out the chaff and getting right down to the kernel of the invention. Many inventors do not know what their invention is until advised by their solicitors. It is a mistake to suppose that the mechanic is a better solicitor than the lawyer. The lawyer's education is one of analysis, and any mechanic is a better mechanic after studying law. The patent solicitor must have a grasp of the law and of mechanics. He may be a lawyer who has studied mechanics, or he may be a mechanic who has studied law. But it is the law of training which fits the solicitor for quick grasp and thorough analysis.

CONTINGENT FEES.

There are all kinds of patent solicitors, as there are all kinds of mechanical engineers and machinists. Perhaps thorough solicitors and engineers and machinists are the exception. The best engineers and machinists can and do generally command the best pay, and so do the best patent solicitors. Those whose competency or reputation will not secure them business at good pay must be content to take poor pay. It may, I think, generally be assumed that the service in any branch which commands the best pay is the best service, but it does not at all follow that in all cases the best men are getting the best pay. Solicitors who do business on the principle of "No patent no pay" sometimes do as good work as anyone, but the principle is generally availed of by those who cannot otherwise command a satisfactory amount of business. A solicitor of well established reputation is always in a position to offer his best services, but his best services may not succeed. The more difficult the road to success the greater the need becomes for good service, and the more service is required, hence the inconsistency of contingent fees when coupled with low fees. But the worst aspect of contingent fees is that they are due when the service results in a patent with the ribbon on it. When it is considered that a patent is often the deed for a very valuable piece of property it is obvious that the mere cost of the deed should not be too closely considered. In giving consideration to patent business done on contingent fees, sight should not be lost of the fact that contingent fees are often coupled with the lowest scale of charges. If the charges are low and then made contingent, special caution is suggested.

But there are cases in which a poor inventor must avail himself of the contingent fee system, but it does not follow that the poor inventor should therefore have poor service. He might, perhaps, go to the best solicitor and say to him, "I am poor and want the best legal services, but I cannot meet your charges, and would need to borrow money to meet any charges. I cannot afford the risk of loss, but if I get my patent I will be a rich man. Therefore join with me in the risk, give me your best service, and if you succeed charge me extra to compensate you for your share of the risk." Some good solicitors can be gotten to render their best services under such an arrangement, the contingent fee being never less than double the ordinary fee. It will be seen that this is not by any means a cheap arrangement, indeed it is the most expensive possible, but it is often a wise one. It is a safe course only with a solicitor whose reputation is so high that he cannot afford to lower the character of his work in order to expedite the getting of the patent on which alone his fee depends.

INFRINGEMENTS.

A manufacturer, aware of possible infringement upon a given patent, may compare his proposed machine with the terms of the claim of the patent, and may find that his machine escapes the terms of the claim, but he will be quite in the dark as to his status until he becomes advised as to whether or not the state of the prior art was such as to prevent the patentee invoking such a liberal interpretation for his claims as would dominate the proposed structure. Bitter fights occur over questions of infringement, the same as they do over all other asserted titles to property. The inventor creates the new invention and gets his patent, and then may arise a conflict be-

tween him and the public; the public seeking to get around the terms of his claim, and he seeking to have its terms expanded to dominate the fancied infringements. If all inventors were pioneers in their lines, then justice could easily be measured out. But in the march of industrial development each inventor adds his mite, and his exclusive rights should be protected, but are often difficult to measure. An inventor may have fancied himself a pioneer and may have gone into the Patent Office with his application, making broad claims. Upon being rejected, in view of the state of the art, he cuts down the scope of his claims, and upon further rejection he cuts down the claims still more, and advances arguments showing delicate distinctions. He then gets his patent and often seeks to hold it over the heads of the public, as having considerable breadth of scope. It is here that the delicate duties of the court are called for in determining the proper limitations to the claim, and hotly contested facts and expert testimony become in order. The courts have referred to cases of this kind by likening certain patent claims to the nose of wax which is twisted one way to get the claim from the Patent Office, and then twisted the other way to make it reach and dominate an alleged infringement. Experts will always disagree over shadowy lines. The deed to real estate calls for land to the center of the river, but the river has long since dried up and geological experts may well differ over its former location.

GOVERNMENT DEFENSE OF PATENTS.

Many patentees complain that the Government grants them patents, and then forces on them the burden of maintaining them; that Government courts often declare the patents weak or void; and they think the Government should sustain its grants.

This view ignores the fact that the Government, in making the grant, can act only on the facts before it. The inventor makes oath that he is the original and sole inventor. It may turn out that the oath is false, and that the invention was gotten complete from the actual inventor and patented with his consent. The Government should not be called on to uphold any such patent. Again, the Government experts search prior patents and the literature of the art, and use their own personal knowledge, and, finding nothing of an anticipating character, the patent is granted. The Government has made fifteen dollars' worth of searches, and the inventor appears to be entitled to his patent, and the patent is accordingly granted. But the Government has no possible means of knowing of unpatented prior public uses. You may invent a peculiar steam engine, and build and sell them for ten years. Some man, a thousand miles from you, invents the same thing, and very properly gets a patent on it, the Government having no knowledge whatever of your past efforts. That patent must fall and the Government should not be asked to uphold it.

Again, an inventor applies for his patent and the Commissioner rejects him on some old patent which appears to be of anticipating character. Thereupon the inventor files a sophistical argument as to the construction and action of the alleged anticipation, and the examiner, half convinced and resolving doubts in favor of the applicant, allows the application and the patent is issued. Later, when the patent is taken into court, daylight is let into the sophistry of the argument and it is shown that the old device is the same as the new device. The new patent must fall.

COPIES OF PATENTS.

The Government has printed copies of most all its issued patents, and manufacturers and others having to do with patents should more fully avail themselves of this fact. They would do well, if much concerned with patents, to have volumes containing copies of those of interest. The Patent Office divides inventions into something over two hundred classes, and these classes are again divided into sub-classes on more or less rational lines. There are over six thousand of these sub-classes. The Patent Office will furnish free on application a classification list. Copies of single patents may be purchased for five cents each; if a complete sub-class is taken, for three cents each; if a complete class is taken, two cents each. Any person can procure these copies from the Patent Office at the above figures. The patent attorney would necessarily charge for services in ordering or for any necessary service. The Patent Office will also enter subscriptions for the mailing of such patents as may issue from time to time in a selected sub-class, a small deposit being made and renewed to cover the cost, at five cents each.

DIGESTS.

Over six hundred thousand United States patents have been issued, and it is unfortunate that the Patent Office has thus far not been able to procure appropriations for digesting them somewhat as the British Patent Office has partially done with its comparatively small number of patents. Such digests of United States patents as have thus far been published are the result or individual enterprise, and the works are necessarily expensive, owing to the great labor and the very limited demand. Manufacturers interested in specific lines of inventions would do well to avail themselves of such digests so far as suitable to their purposes. These digests have been the outgrowth of special activity in certain lines of industry at certain times. I have never seen a complete list of these digests, and do not know that one could be made; but I here append a list as complete as I can make it, viz.:

Sewing Machine Attachments. By George W. Gregory. 1872.

Breech Loading and Magazine Small Arms, except Revolvers. By V. K. Stockbridge. 1875.

Seeding Machines and Implements. By James T. Allen. 1878. With certain supplements since.

Plows and Attachments. By James T. Allen. 1883.

Agricultural Implements. By James T. Allen. 1884.

Harrows and Diggers, Seeders and Planters, Cultivators, Harvesters. By James T. Allen. 1886.

Cycles or Velocipedes, with Attachments. By James T. Allen, 1892. With certain supplements.

Underground Lines. By James W. See. 1886.

FOREIGN PATENTS.

Good foreign patents are extremely valuable property, but it does not follow that all foreign patents are of value. Not one in a hundred of American inventions, even if they are somewhat profitable, are worth the cost and trouble of foreign patents. The cost of foreign patents is heavy, and in most cases the continued validity of the patents is contingent on the payment of taxes and the local working of the invention. If a customer is promptly found under the foreign patent, then its taxes and working offer few difficulties; but if no customer is found within a year it becomes a serious matter to perform the legal working. Little or no confidence should be placed in nominal or paper workings, and even these are expensive. In some countries taxes begin and the invention must be worked at the end of the first year, and the working must not permanently cease; and in the case of Canada the continued validity of the patent restricts the power to import the invention into Canada. An invention which has made good profit in America and is a matter of foreign requirement, is well worth foreign patents, and the customer may often be found in view of the American success. But the trouble is that the foreign patenting cannot be delayed until American success determines its expediency. In some foreign countries the patent would be rendered void by prior patenting or disclosure, and in America the patent expires with the term of the first expiring previously granted foreign patent. Hence, to avoid any ante-dating, all the patents should bear about even date. Date can be made for foreign patents by merely filing the applications, while in America the date of patent is the date of grant, and may be months of even years after the date of application. Hence the proper course is to take no steps regarding foreign patents till the United States application is allowed. Then select the proper future issue day for the United States patent

and cause all the foreign applications to be filed on that day. An exception is to be made in case the invention goes into public use before the issue of the United States patent. In such case the shortening of the life of the United States patent must be submitted to, and the foreign patents should be taken out before public disclosures would render them void.

In most foreign countries patents are granted as a matter of course, without examination into novelty, and the grant of the patent is no evidence whatever that the patent is good for anything. In Germany applications are examined, and generally rejected. The merit which will insure the grant of a German patent is not at all to be measured by American standards.

Briefly, then, waste no money on foreign patents unless prompt results are in sight, or unless the invention is of importance enough to justify the expense and trouble due to recurring taxes and legal local working of the invention; foreign patents should antedate invalidating disclosures of the invention; it is desirable that all patents on the same invention bear even date. This latter can be secured by filing the foreign patents in the interval between allowance and grant of the United States patent.

(The End.)

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Boring and Turning Irregular Shapes.

If we ever stop to think of the matter, it is somewhat strange that in the machine shop the work has been so strictly confined to circular shapes. It is so easy to demonstrate the desirability of other outlines under certain conditions that only the difficulty of producing them with the regular facilities of the shop has prevented their at least occasional employment. Where there is, as often occurs, great difficulty in holding a wheel securely on a shaft, how simple the thing would become with an elliptical section of shaft at the spot where the wheel was placed, an elliptical hole in the hub, and the hub open at one side with suitable bolts for tightening.

The inventors of rotary engines have a habit, among others which are perhaps more objectionable, of requiring shapes which are other than truly circular for the shells or other parts of their engines, and for the production of some of these the ingenuity of the shop is often taxed to its utmost. The needs of the rotary engine man are so imperative that when he demands the unaccustomed shapes they are usually forthcoming, and thus to his exacting demands we are indebted for some interesting shop problems and their happy solution. One or two of these have recently come to our notice, and we take pleasure in calling the attention of our readers to them.

In the interesting group of pneumatic tools of the American Air Motor Company, recently described in our columns, it will be remembered that the shell of the motor is not a true circle, but is slightly ovoid in shape, the departure from the true circle being so little as to make it perhaps more difficult to produce the required shape correctly than if

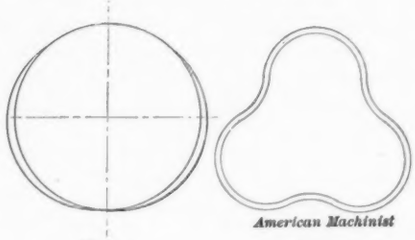

Fig. 1 Fig. 3

UNUSUAL SHAPES TO BORE.

the irregularity of outline were more pronounced. The device employed, however, was very neat, workmanlike and satisfactory. The shape of the shell is indicated in Fig. 1, where the inner line is the true circle and the outer line indicates the outline required. This is not a true ellipse, but is bigger below the central line of the figure than above it. The simple sketch, Fig. 2, will suffice to show the device employed. The cross screw was removed from the rest, so that the sliding block which carried the boring tool was free to slide back and forth. At the back of the lathe and somewhat lower than the top of the carriage was the rocker shaft *A*, say, 2 feet long, lengthwise of the lathe, and held up by a couple of brackets, *F*. There were two short levers, *B*, on this shaft, one near each end, and these carried the bar *C*, a hook, *E*, from the tool-carrying block sliding on this bar. As the shaft rocked the tool would be moved backward and forward and the desired outline be thereby produced. On the end of the lever just opposite the face-plate was the long vertical lever *D* with a roller on the end which ran in contact with the edge of the face-plate. A spring, not shown, constantly pulled the lever toward the face-plate. It was only necessary then to give the required cam-like outline to the edge of the face-plate to produce the required movement. As the length of the lever *D*, as actually used, was at the roller seven times that of the levers *B* the departure from the true circle on the edge of the face-plate were also seven times as great as in the hole to be bored. The outline of the face-plate was not the same as that of the work to be bored, each movement of the boring tool from the center out-

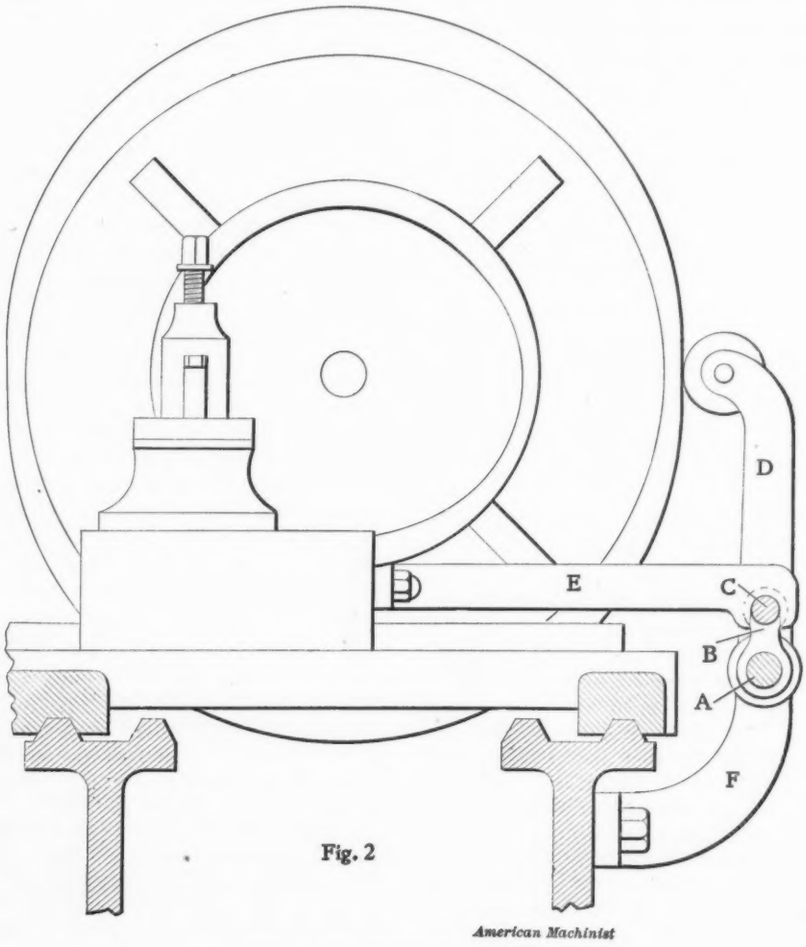

Fig. 2

CAM ACTUATED BORING RIG.

ward requiring a movement of the roller in contact with the edge of the face plate toward the center, and vice versa. The edge of the face-plate was plotted and shaped approximately and quite closely to the requirements, but the final adjustment of it was by careful trying and correcting. A shell was bored, the blocks of the motor piston were put in and adjusted and revolved, and the places where they touched the shell were marked. The corresponding places on the edge of the face-plate were then filed a little lower, which would make the tool bore a little larger at those spots on the shell. This "cutting and trying," or, rather, in this case trying and cutting, was continued until a shell was produced in which the blades showed perfect contact for the entire revolution, and then no further adjustment or correction was required. The bore of the shells produced is now so perfect as to leave no opportunity for scraping or any other correction by hand.

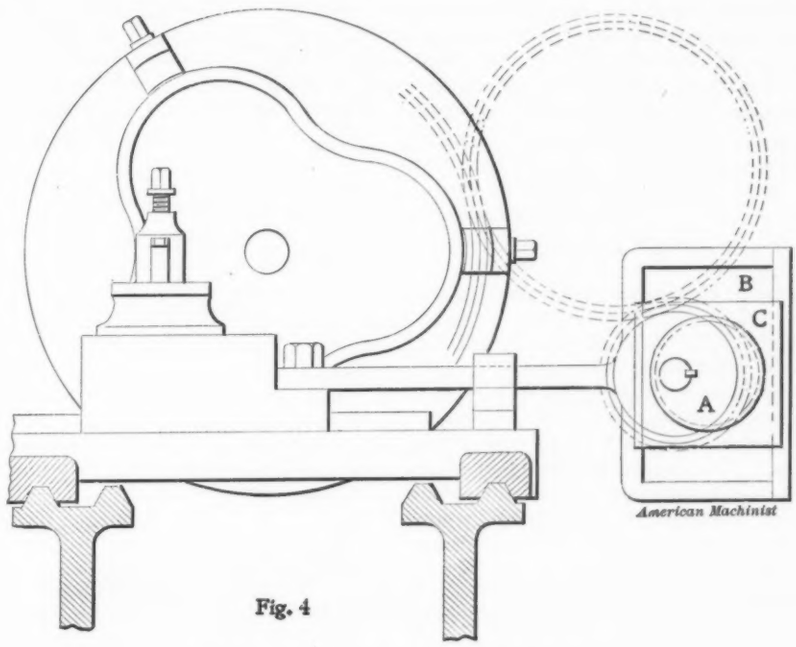

Fig. 4

BORING RIG ACTUATED BY ECCENTRIC.

A very different case is presented in Fig. 3. Here the departure from the circular shape is so great as to suggest a very different treatment. This is approximately the shape actually required for another rotary engine, and the arrangement here sketched was recently employed for boring the shell for an experimental engine at the shop of Geo. M. Ball & Son, Greenpoint, N. Y. In this case the required movement of the tool was secured by the eccentric *A*, Fig. 4, which was geared to make three revolutions to one of the spindle. The shaft which carried the eccentric was run in two fixed bearings and was splined the entire length between the bearings, the eccentric sliding upon it as the rest was fed along. The slide *B* in which the eccentric block, or crosshead *C*, moved was attached to the tool carrier and moved in and out in a horizontal line, giving a corresponding movement to the tool. It was of course necessary to avoid in this case the derangement of movement which would have been caused by the employment of a connecting rod or eccentric rod.

In the outline thus produced, or in the means employed for its production, there is of course in principle absolutely nothing new. Myriads of intricate profiles have been produced by the geometric lathe, but such work is still unusual for the average machine shop. The arrangement suggests possibilities of new fields of usefulness in the shop. If the eccentric were geared two to one instead of three to one the figure produced would be an ellipse, while if the spindle and the eccentric turned at the same speed the shape turned would be circular but eccentric to the axis of the spindle. It would thus be possible to turn an eccentric upon a shaft without throwing it out of the center, or to bore both concentric and eccentric portions of the same piece at one chucking. With provision for varying the throw of the eccentric, and with gears to give different ratios of revolution, eccentric, elliptic, trefoil and quatrefoil turning might not be so rare in the shop as at present, and, what is perhaps not so delightful, inventors might take courage to demand still more peculiar work.

There is one objection to the use of the device here shown which should not be lost sight of. The tool, whether turning or boring, must necessarily have sufficient clearance for the most pronounced departures from the tangent that occur. In the outline shown in Fig. 4 the cutting edge must be weak on account of this excessive clearance, and must wear rapidly, even though it would also be impossible to take as heavy cuts as would be possible in regular concentric turning.

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Letters from Practical Men.

Introducing Machine Tools—The Vertical Shaper.

Editor American Machinist:

I have spent right in the shop more years than I now care to brag about, and at one time or another I have known a lot of first-class mechanics, men who were mechanics by birth, by education and by wide experience. I have seen a great many of the steps, if they may be called steps, rather the constantly gliding movements by which the trade has been transformed, by which the changes in the ways of doing work, and in the rate of doing work, have come about, and how the tools and facilities for doing work have worked their way in. I have known lots of handy tools and labor-saving contrivances got up at different times in the shop for special jobs, but it has not been from these that the permanent improvements and advances have come. I have to confess, although of course everybody knows it, that progress has been forced upon the trade from outside the shop rather than persistently sought and developed from within.

We could have gone on contentedly enough bolting our work to the face-plate, and often bolting on wooden blocks and turning them out to make a bed for our castings and then bolting our work on, and lots of contrivances of that sort we could have actually taken pleasure in, but the chuck men upset all that. Lookers-on see most of the game, especially if they understand the game and are interested in it, and so they came along with their chucks of different styles, some adapted to some lines of work and some to others, and they believed in their chucks, and they talked long and loud about them, and soon got some of the shops to take them up, and after that the other shops had to get them in self-defense. Twist drills and taps and dies and reamers, and then the graduated scales and micrometers and gages, have all had their introductory runs through the shops since I have been looking on. They have all had to be pushed by somebody at the beginning; later they have gone easier, and then they have rushed into the shops and stuck there, and the pull that would now be required to get them out would be infinitely greater than the initial push that was exerted to get them in. There has been the same experience with lathe dogs and

all the line of vises and chain hoists and emery wheels. The names of individuals and firms are familiar to all as the special pushers of each specialty.

It has been the same with the larger machine tools, the shaper, the milling machine in its various forms, the upright boring mill, the turret lathe, the screw machine; they have all had to have their pushers at the first, but now they all securely hold their own. Then there have been improved feeds and speeds and quick returns and handy movements that have all had to have their eager advocates at the first, but which are now demanded all around.

I believe there is probably just as much chance for enterprise in this direction as there ever was. It is not of course possible to tell in advance what can be done, but if anyone will call upon me two years from now I will not have any difficulty in showing the differences in machine shop practice. Even to-day I am very confident that there is a great chance for some competent pusher to do something big with the slotter. It has never had a pusher, and consequently it has never had its chance. The pusher, to be successful, would have much more to do than just to talk it up. It has had a fair share of the talk of the shop, but the talk has not helped it.

The first thing to do is to change the name of it. The slotting machine is not a slotter any more than some other machines are slotters. The other day I saw a gang of milling cutters cutting out the slots in a big gridiron valve, and slots of various kinds and sizes I have known worked out in the lathe, the planer, the shaper, the boring machine and elsewhere, many of them in shape, situation or dimensions impossible to do on the slotter. The original slotter was probably made and used for working out the slots in connecting rod ends, and that has handicapped it ever since. I have seen several slotting machines in use at different times and places; they are not very numerous, and yet it has been the exception rather than otherwise to see them working out slots. The work to which they are best adapted is almost identical with the work of the shaper, and if we call the slotter a vertical shaper we will have it more correctly named than it is at present.

When we get the name corrected there will be some chance of getting the idea behind the name correspondingly changed. When we get the idea that the machine is not primarily and principally a slotter we may also be able to see that the cutting tools for it should not be slotting tools exclusively. In the advertising pages of the "American Machinist" of recent date there is a large cut of a likely looking slotting machine. The ad. says that it is "built for hard work." It has a 10-inch stroke. What kind of hard work will be done by a tool reaching down over 10 inches from the holder? It may be necessary sometimes to work in a slot, and the tool should then be able to do it, but as a general thing the vertical shaper should have a tool shank at right angles to the slide, just as any other shaper has it. Then the machine would be able to talk about doing hard work, and it would not be long before we caught a great many of those machines actually doing hard work. The turntable and the slides in both directions and the feeds usually provided are not particularly suggestive of slot work, but they do furnish unusual facility for working all around a piece of regular or irregular outline, and the table furnishes the ideal mode of holding the work to meet the cut without springing. The end of the slide might in many cases carry a turret with three or more tools of different styles and all able to give a good account of themselves. The vertical shaper only needs a pusher, one who will, first of all, make the simple changes necessary to enable it to work on equal terms with its competitors and who will then see that it has the work to do. Later the tool will do its own pushing.

TECUMSEH SWIFT.

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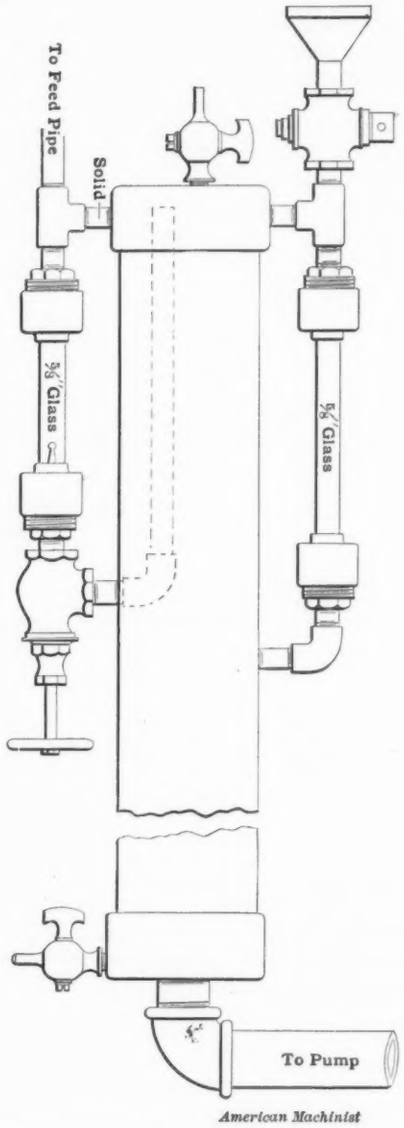
Feeding Kerosene to Steam Boilers.

Editor American Machinist:

One of the many things that have to be looked after in a steam plant is a suitable boiler compound. What will do in one boiler may be useless or harmful in another. The remedies for preventing boiler scale are numerous, and, like some patent medicines, are warranted to cure in all cases. There are no doubt many valuable compounds on the market as well as utterly worthless ones. The use of kerosene is quite extensive in certain localities, and is found to answer the purpose. For years we have used kerosene in our boiler, and it is certainly an economical scale preventive compared with some of the compounds daily offered. The usual method of feeding the kerosene was by putting in from four to five quarts when the boiler was cleaned, which was, and still is, usually done about once a month. This practice produced good results, but not the best, as we have found out.

The sketch shows an oil feeder, which we have built and have now in constant use. It is made, as will be seen, of common pipe fittings, and the total cost was small. The large central pipe, 4x36 inches, is the oil reservoir. The 1½-inch pipe at the bottom, connecting with the pump or feed pipe, is made so large merely to carry the weight, as very little water flows through it. This pipe has a globe valve for shutting it off. The water-glass on the right is to show the level of the oil in the reservoir, and the glass on the left is a sight feed for regulating the quantity of oil used. The small pipe above this glass runs direct into the feed pipe, which passes along a little above. This pipe also has a valve by which it may be shut off. The upper nipple on this side is closed tight by a lead plug, and its only use is to steady or help support the glass. The lower nipple extends inside the oil reservoir, and has an elbow and a vertical pipe inside, the latter extending nearly to the top of the oil chamber. The little valve below the glass regulates the flow of the oil, or the frequency of the drop.

The entire apparatus is normally filled



FOR FEEDING KEROSENE TO BOILERS.

with water at feed pipe pressure, except where the oil is present. To fill the reservoir with oil the connections to the feed pipe are closed and both pet-cocks are opened. When the water has run out at the lower pet-cock it is closed, and the oil is poured in by the little funnel up at the right until the reservoir is filled, when the cock below the funnel is closed and the connections to the feed pipe are

again opened, the upper pet-cock also being closed as soon as all the air is out.

The operation of feeding is simple. The oil in the reservoir is always at the top and the water below it. The oil passes down the little pipe and out to the left, by the regulating valve, and drop by drop up through the glass and into the feed pipe. The usual feed is only about a drop a minute. The drops are very large.

The only trouble that we had was in making a tight joint for the glasses. We tried various packings, but with 75 pounds pressure the oil would leak through. A solid rubber washer, about 1 inch long, made to fit the glass, and also the inside of the reducer, finally made a tight joint.

Our boiler feeding is done by a vertical constantly running plunger pump of somewhat larger capacity than required, and the feed is regulated by a run-around pipe and valve connecting the pump barrel with the suction pipe. As our work is steady this valve can be set to require adjustment not more than once or twice a day.

E. H. DUTCHER.

Jersey City, N. J.

▲ ▲ ▲

A Job of Boring.

Editor American Machinist:

Given the task of boring a 5/8-inch hole endwise through a hard steel spindle 7½ inches in diameter and 5 feet long, with a large and powerful boring lathe, such as is used on gun work, and the work would be comparatively easy and rapid. Having only the equipment of an ordinary machine shop, the case becomes more serious. In the regular course of business such a job was required to be done, and the work was performed perfectly and expeditiously, as will be described. Fortunately, a boring lathe was at hand, fitted with a chuck and provided with a sliding carriage, operated by an automatic feed and designed to bore a 2½-inch hole, 25 inches deep. One end of the spindle to be bored was fixed in the chuck and the other run in the jaws of a center rest, as shown at *d*, Fig. 1. An expert blacksmith forged a twist drill 2 inches in diameter with a twist of 31 inches in length, which was turned up and finished, and with this a hole was bored a little over 30 inches deep. A soft brass tube of about .2-inch bore carried oil under pressure to the point of the drill and on its return brought out the chips. The spindle was then reversed and the hole was bored from the opposite end until the two holes met, which they did quite exactly.

Now came the work of enlarging the hole from 2 inches to 5⅛ inches. It is to this part of the work that particular attention is called. As the means for holding the drill had proven very rigid and satisfactory, a boring bar was constructed, as shown in Fig. 1. The cutters *a* and *b* were of ¾-inch round steel, fitted in the usual way, and held by set screws *c*, the bar being placed in a lathe and its ends turned off, so that the cutter *a* would measure 3⅞ inches and *b* 5⅛ inches. The end of the bar just fitted the 2-inch hole already bored in the spindle, thereby furnishing a correct and certain guide and support near the cutters. The cutting ends of the cutters were formed as shown in Fig. 3, *i. e.*, the face of the cutting edges being inclined 5 degrees and the leading edge 25 degrees, making the angle of the cutting edge 60 degrees, which proved to be a very effective construction, the cutter *a* enlarging the hole to the extent of taking out about half of the stock and the cutter *b* removing the remainder.

The spindle was then reversed and the operation continued from the opposite end until only a small portion of the 2-inch hole was left to guide the boring bar. The bar was then withdrawn and a disk *c* fitted to it. This disk was 5⅛ inches in diameter, so as to just fit the enlarged hole and furnish a guide for completing the enlargement of the hole, as shown in Fig. 2.

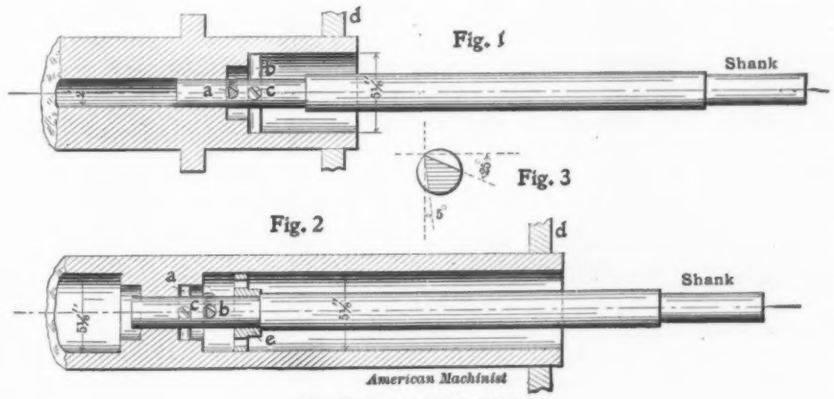
The work was successfully done, a true, smooth hole bored, the two sections of which coincided perfectly. It will be noted that in this job the hole was very large in proportion to the exterior diameter, and a large amount of stock was taken out; in fact, nearly 350 pounds of hard steel. This was removed at the rate of nearly 30 pounds per hour.

The plan will doubtless commend itself for similar work, and where there is even a greater difference between the directing hole and the finished bore three or more cutters might be used to advantage.

OSCAR E. PERRIGO.

New Haven, Conn.

[If our correspondent could have given a description of the first drill, which did such a wonderful feat in drilling from each end and meeting "quite exactly," his communication would have been more satisfactory. Not every mechanic could do that job as perfectly as described above.—ED.].



BORING A LONG HOLE.

▲ ▲ ▲

Patenting Impossibilities.

Editor American Machinist:

An article in your issue of April 14, entitled "Governmental Demoralization of Patent Solicitors," does great injustice to the Patent Office and to patent solicitors also. The Patent Office and its examiners have certain duties to perform, regulated and controlled by the laws which Congress has prepared for that purpose. Before you charge that office with unfaithfulness, do you not think you ought to examine the law; find out whether it is as it *ought* to be or not, and whether the examiner could do otherwise than he did? Whether the law is as good as it might be is not in question, and it is certain that under the law *as it is* there are but two grounds on which the office can refuse to grant a patent for anything which an applicant swears he has invented: 1. Lack of novelty—the same thing having been invented before, as shown in such a patent or such a book. 2. Manifest harmfulness to the public, as something immoral in its nature. This is the cold fact of the law's definition of the examiner's duty. Now what must he do when an an applicant comes with a sworn statement that he has invented this thing, and it cannot be shown that anybody else was foolish enough to invent it before him? You say the patent ought to be for a *useful* invention, but the law, as construed by the Supreme Court, says utility must be inferred unless the thing is manifestly harmful—*because* the question of the utility of a new and untried thing cannot be safely intrusted to the judgment of any man or set of men in advance of ample test and experience. But you say this thing is manifestly devoid of utility, and the patent ought to be denied. That may be true, but to permit the examiner to act upon his judgment would be to substitute a man's judgment, which may be dyspeptic, in place of the law. And worse than that, for there are some forty men in the Patent Office who would have equal privilege, and it is easy to see the time would not be far distant when the law wouldn't be in it. It must not be forgotten that originally patents were rejected because in the judgment of the officer the inven-

tion was not sufficiently "useful and important," and these judgments became so notoriously unsafe and unjust that the Supreme Court relieved the case by holding that utility must be inferred.

The patent solicitors are not to be condemned for having acted also under the law. It must be remembered that no application for a patent is made without an applicant behind it with both money and faith. Supposing a solicitor says to his client, "This thing is worthless and I won't take your money"; in ninety-nine cases out of a hundred the client will say "Whether it is worthless or not is my business and not yours, and I know more about it than you do." Then he would betake himself to a wiser solicitor, and the first would have lost a client and a fee without accomplishing anything but profit to a rival.

It must not be forgotten that every invention is a reach out into the unknown, and that no man is competent to pass judgment upon it in advance of experience. While there may be many things which can be figured out there are more which cannot, because friction and the coal pile are not always the elements which control success, and there is no way of making a fast and loose rule which will hit if the thing is bad and miss if it is good. R. D. O. SMITH.

Mishawaka, Ind.

[Under our established practice of allowing the fullest freedom of discussion and fair play to all, it seems proper to print the above communication. Its value would seem to be principally as an example of what should be avoided by those who undertake to criticise or discuss previously published matter. One thing to be avoided is undue haste. It is not wise to attack any article without first having read it, as in this case the writer evidently has not. The purpose of the article referred to was to call attention to a recent patent for an absolute impossibility. If a thing which, under no circumstances, would or could perform what the specification alleged was its function, could be called an invention, and if such an invention was patentable we would like to see the definition under which it is included, and we would be glad also to see the law under which the Patent Office is required to issue a patent for it. The patent being for a roller bearing there should be not only rollers, but in operation there should be a rolling of the rollers, and this, as we showed, was impossible. A patent should certainly be for an invention—whether useful or not we are not now discussing—and the thing described in our article was not an invention, but an absolutely inoperative creation of an erratic imagination.—ED.]

▲ ▲ ▲

Chart for Proportions of Dies.

Editor American Machinist:

I send you a chart for laying out solid dies for screw machines and other work on which such dies are used.

Where a number of dies of this style of different sizes are used and have to be replaced and new ones made frequently some system with proper tools for doing the work renders it much easier and more satisfactory. This scheme for the proportion of solid screw dies can be arranged to suit anyone's ideas of what those proportions should be and is similar to those shown in the "Machinist" at different times for mandrels, reamers, drills, etc.

These results can be obtained by laying out a 1-inch die and figuring from that, or by laying out the largest and smallest die used any convenient distance apart—which distance can be crossed by as many lines at equal distances apart as there are to be different sizes of dies, then connecting the two circles representing the extreme sizes by lines. The intersection of these lines with the parallel ones previously drawn will give the intermediate sizes by measuring the distances with scale. This method requires little figuring.

I made the chart in this manner: First I assumed the proportions of a 1-inch die. Then to obtain a constant for the diameter of blank I divided the square of the assumed diameter, 2⅝ inches, by the square of the diameter of the screw which the die cut, which was 1 inch. That gave me 6.89 as a number to multiply the square of any screw diameter by, the product of which, after extracting the square root, gave the required diameter for a die blank for that screw.

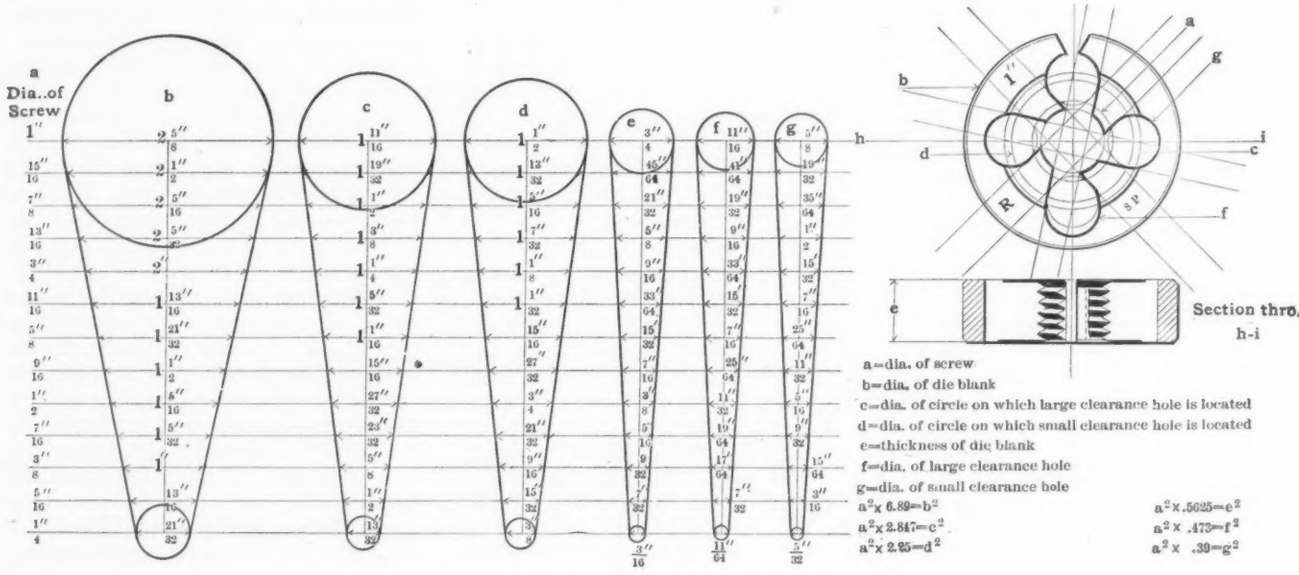


FIG. 1.—CHART AND FORMULAS FOR SOLID SCREW DIES.

I proceeded in a like manner with all the other dimensions and obtained the constants and constructed the formulas shown on the chart. The figures given for the different dimensions are to the nearest sixty-fourth of an inch, and I think on using the formulas for each respective dimension they will be found to be correct, many of them exactly to the figures in thousandths and others varying only five or six thousandths, not a drill size difference.

The manner of laying out the die is shown on the chart, the finest lines connecting the different circumferences and centers of circles to produce the desired form of die.

I prefer to have a holder for each size of die, but of course it can be arranged to have one holder take two or more sizes. MACHINIST.

[As giving the proportions for dies which have proven satisfactory in use the above is all right, but we think the usual form of diagram is preferable, partly be-

cause it is the usual form and therefore familiar and partly because a diagram in the usual form would occupy only about one-fourth as much space. We give an idea of such a diagram at Fig. 2 for comparison. Measuring from the bottom line

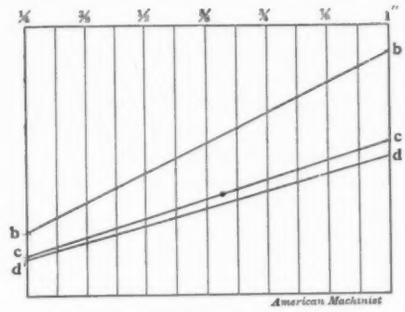


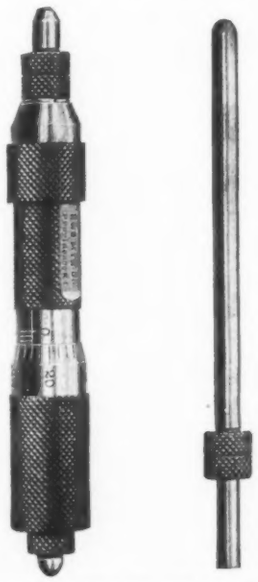
Fig. 2
USUAL FORM OF CHART.

upward on the vertical line indicating the size of die to be made to the diagonal line indicated by the letters gives the required dimensions at once. Both diagrams are made to reduced scale, and must be full size, of course, in order to be available for use.—ED.]

▲ ▲ ▲

Inside Micrometer Caliper—Micrometer Depth Gage.

The Brown & Sharpe Manufacturing Company, Providence, R. I., has recently brought out two new measuring instru-



INSIDE MICROMETER CALIPER.

ments, which we illustrate by the accompanying engravings. Figs. 1 and 2 show a depth gage, designed to measure all depths up to 2½ inches by thousandths of an inch, and some new features are introduced in its construction designed to facilitate handling and to permit ready compensation for wear.

The measuring rod *A* passes through a split chuck *B* (Fig. 2). The inner surfaces of the four spring jaws composing this chuck are plain as usual for holding the rod by friction only, but have formed at their upper extremities a V-shaped ring, which engages with any one of five small annular V grooves cut on the rod exactly ½ inch apart. The micrometer screw has a movement of ½ inch, and when set at zero and with the rod engaged with the lower notch as shown, the end of the rod will be just even with the face of the gage. Depths up to ½ inch can then be measured and indicated by means of the micrometer graduations, and for depths beyond ½ inch the chuck *B* is loosened and the rod shoved down

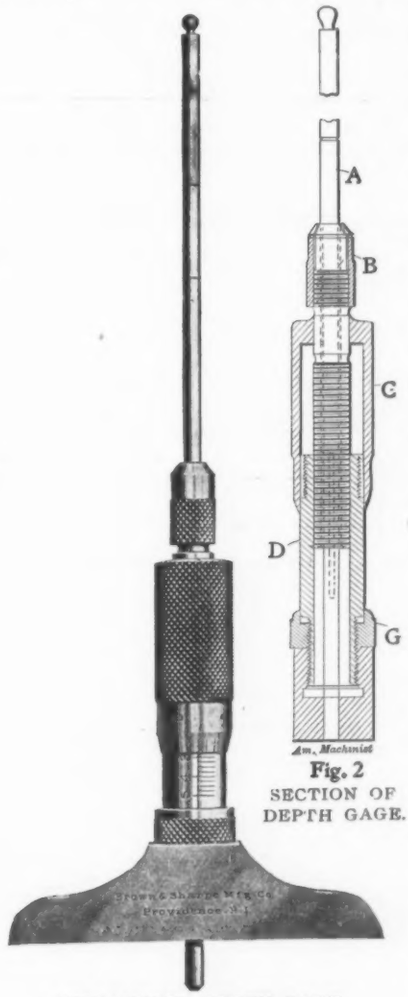


Fig. 2
SECTION OF DEPTH GAGE.

MICROMETER DEPTH GAGE.

to the required notch, each notch adding, of course, ½ inch to the depth indicated by the screw.

Supposing the end of the rod (which is hardened and ground) to have become worn sufficiently to affect the measurement, this wear can be compensated for by loosing the knurled nut *G*, Fig. 2, when the instrument being set to measure zero depth, as before described, the entire barrel can be screwed down into the body of the gage until the wire is flush with the face as before, when by again tightening the nut *G* the adjustment of the instrument is completed.

There is also means of adjusting the nut of the micrometer screw. The face of the gage is hardened and ground and the jaws which engage the notches on the measuring rod are also hardened.

The inside micrometer caliper is shown in Fig. 3. In this tool the micrometer screw also has a movement of ½ inch, and in the end of the graduated sleeve to which the concealed micrometer screw is attached is fitted a small contact piece (at the bottom of Fig. 3). This is of steel hardened and ground, and provision is made for adjusting it to compensate for any wear that may take place by means of the small knurled nut shown, which is also adapted to receive a small spanner wrench.

Rods varying in length by exactly ½ inch are fitted to the other end of the caliper and form the other contact piece. The shortest of these (½ inch long) is shown in the caliper and a longer one (2½ inches) is shown at the side removed from the caliper. The longest rod used is 3 inches and the caliper measures from 3 to 6 inches. The rods referred to are held in a split chuck tightened by the knurled nut with conical top, and when inserted are simply pushed into the caliper until the two knurled nuts fitted to it come into contact with the end of the chuck, and the nut is then tightened. To compensate for wear the nuts fitted to the rod may be moved; one of these is adapted for a small spanner wrench and acts as a check nut to hold the other in place. Both these tools are put up in plush-lined leather cases.

▲ ▲ ▲

The Richmond (Va.) Locomotive & Machine Works recently received an order from the Finland (Russian) State Railway for seventeen compound locomotives.

▲ ▲ ▲

So far as known the triple expansion crank and fly-wheel pumping engines to be built by the Lane & Bodley Company, of Cincinnati, for the water works of that city, will be the largest machines ever built for any purpose. They will have a capacity for pumping 30,000,000 gallons per day each. Each engine (three have been contracted for) will weigh 2,833,000 pounds or 1,414 tons.

▲ ▲ ▲

Even Spain shares in the general rush for American electrical machinery. The Westinghouse Electric & Manufacturing Company, through its London representatives, has installed one of its 135 kilowatt single phase separately excited alternators, belted to a Westinghouse engine, for the Malaga Electricity Company, of Malaga, Spain. The decay of Spain's power might be traced largely to the absence of engineering ability among her population. She cannot build her own machinery, and in most cases she is unable to operate it when it is built.

Two Good Taper Boring Bars.

The accompanying engravings are from working drawings kindly furnished us by Bement, Miles & Co., of Philadelphia, and show two taper boring bars in constant use in the works of that company.

The first, shown in Fig. 1, is more especially intended for use in an elevating table, horizontal boring and drilling machine, parts of which machine will be recognized in the engraving. It employs the traveling tool head, both bar and work being stationary, so far as longitudinal feed is concerned. This style of taper bar is in common use, but it will be seen that this one is carefully worked out in its details and is much more mechanical in its construction than is customary.

The bar will be seen to be forked at its tail end, this fork spanning a tongue formed on the end of an extension tail piece, which is turned to act as a journal, fitting in a bush held in the yoke which spans the table at the tail end of the machine. At the driving end the same construction is repeated, except that the tongue is formed on the bar, the fork being part of a foot piece bolted to the face plate of the machine. The taper is adjusted by sliding the foot piece across the face plate with the fork bolts loosened. The forks and tongues being a good fit, the tightening of the folk bolts clamps the bar rigidly at both ends, insuring a steady and powerful drive, to which the substantial bearing at the tail end contributes. The feed screw is indicated with sufficient clearness, as is the arrangement of bevel gears and cross shaft, on which a star is mounted for engagement with the pin shown bolted to the work table to accomplish the feed of the head along the bar.

The range of taper of which this bar is capable is obviously only limited by the capacity of the machine on which it is used.

The second bar, Fig. 2, is of a type which is new to us. Unlike the first bar, this one travels with the feed, though there does not seem to be any reason why, with proper arrangements, the work might not travel.

The bar will be seen to be cast in halves and with a suitably cored interior. Across the bar, at its center, longitudinally, is the tool block *a*, with the tool mounted thereon, as shown. This block is fitted to slide across the bar, while fitted in the bar is a blade *b*, having an inclined rib *c*, which enters and fits a corresponding groove in the tool block. This rib has an ear *d* at its left hand end, to which a threaded rod is attached. This rod is secured to the frame of the machine, so that as the bar is fed to the right the blade remains stationary, and of course feeds the tool outward on an angle corresponding to that of the rib on the blade.

A change of the taper to be bored can only be made by making new blades and tool blocks, while the degree of taper is obviously limited by the size of the bar. In fact, the bar must be of considerable size in any event, making the plan scarcely applicable to very steep tapers or to small work, but where applicable it is considered by Bement, Miles & Co. to be the best construction for the purpose known to them.

It will be seen that the action would be the same if the bar were stationary and the feed effected by traveling the work—the blade being drawn out of the bar by an attachment to the work carriage.

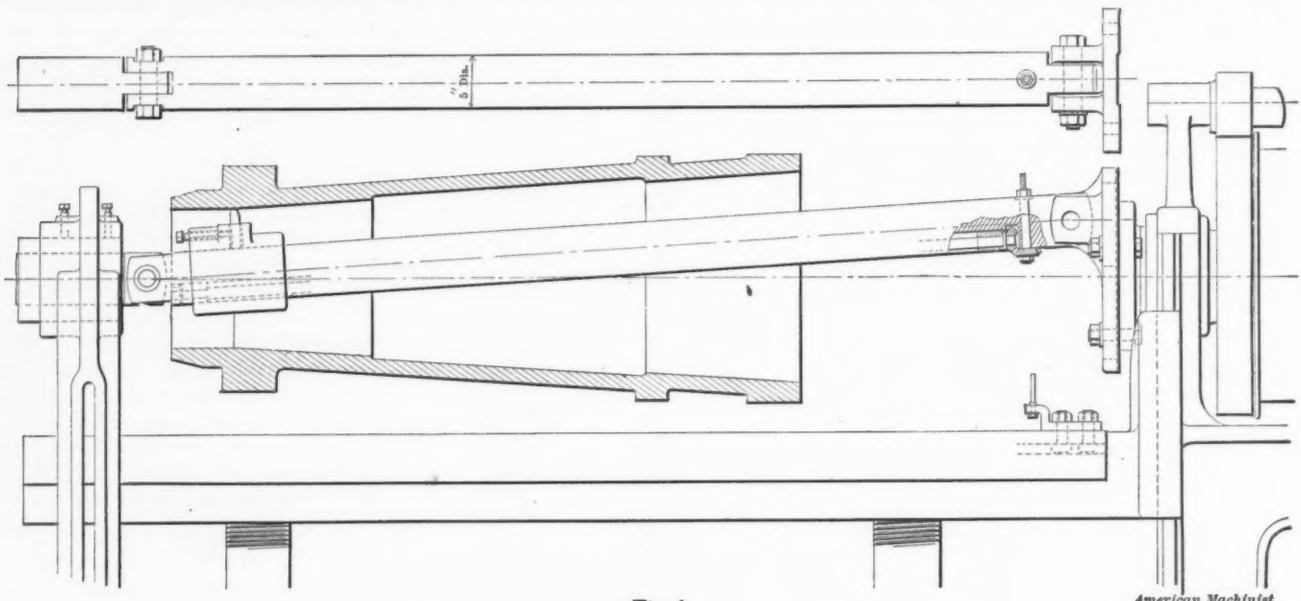


Fig. 1

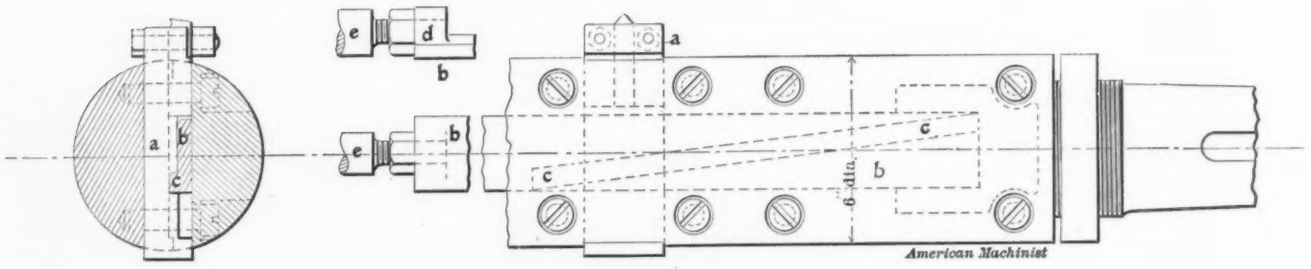


Fig. 2

TAPER BORING BARS.

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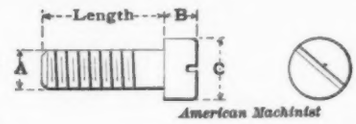
Stock Lists of Bolts, Set Screws, Taps, Etc.

Mr. H. M. Norris, superintendent of the Bickford Drill & Tool Company, sends us a collection of blue print stock lists, of which the accompanying Fig. 1 is a sample. It will be seen to relate to fillister head machine screws. The numbers entered in the various squares indicate by their position in line and column the screws of that style which are regularly kept in stock. The numbers entered are

STYLE A.

FILLISTER HEAD



MACHINE SCREWS

BICKFORD D. & T. Co. CINCINNATI, OHIO.

DIMENSIONS			LENGTHS REGULARLY KEPT IN STOCK.																			
A	B	C	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	2	2 1/4	2 1/2	2 3/4	3	3 1/4	3 1/2	3 3/4	4	4 1/2	5
1/4	5/16	3/8	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
5/16	7/32	27/64	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
3/8	1/4	17/32	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
7/16	5/32	37/64	....	....	....	....	....	....	....	....	69	....	....	....	....	....	....	....	....	....	....	....
1/2	7/16	11/16	....	....	....	....	85	....	87	....	89	....	91	....	....	....	....	....	....	....	....	....
9/16	1/2	47/64	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
5/8	9/16	37/32	....	....	....	....	125	....	127	....	129	....	....	....	....	184	....	....	....	....	....	....
3/4	7/16	1	....	....	....	....	....	....	....	....	....	150	....	152	....	....	....	....	....	....	....	....
7/8	1/2	1 1/32	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
1	9/16	1 1/16	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....

FIG. 1.—CHART SHOWING SCREWS KEPT IN STOCK.

ACME AND SQUARE TAPS.

A — ACME. S — SQUARE. B — BOTH.

DIAM. OF TAP.	HAND.	THREADS PER INCH. 1		2		3		4		5		6		7		8		9		10	
		S	D	S	D	S	D	S	D	S	D	S	D	S	D	S	D	S	D	S	D
1/4	R																				
	L																				
5/16	R																				
	L																				
3/8	R																				
	L																				
7/16	R																				
	L															S					
1/2	R																				
	L																				
9/16	R																	A			
	L																				
5/8	R																				
	L																				

FIG. 3.—CHART SHOWING SPECIAL TAPS ON HAND.

the numbers of the squares, as will be seen by counting them. These numbers, together with the style letter at the head of the sheet, together form the symbol which designates that particular screw. Thus screw A 89 is a fillister head screw, ½ inch diameter and 1¾ inches long.

Each style of cap screw, bolt, set screw, taper pin, washer, etc., has its page. These pages are 6x9 standard, and are bound by wire fasteners. The bins for holding the screws are made as shown in Fig. 2, and consist simply of long shelves supplied with loose boxes 8x9x10 inches. A 69 being the smallest style A screw carried in stock, it is placed in the upper left-hand corner, following which on the same shelf are all the other sizes of this style. Should it be desired to add a ½x2-inch screw to the stock an empty box is removed from the right end of the row and introduced between the two boxes marked A 89 and A 91, respectively, thus maintaining the series at all times no matter how many additions are made.

A60 7/16 × 1 1/2	A85 1/2 × 1 1/4	A87 1/2 × 1 1/2	A89 1/2 × 1 3/4	A91 1/2 × 2 1/4							
B22 5/16 × 3/4	B25 5/16 × 1	B62 7/16 × 3/4	B65 7/16 × 1								
C42 3/8 × 3/4	C 5 3/8 × 1 1/4	C47 3/8 × 1 1/2									
D											
E41 3/8 × 1/2	E42 3/8 × 3/4										

FIG. 2.—ARRANGEMENT OF BINS.

Mr. Norris also sends us a tap list form for Acme and square thread taps, reproduced in Fig. 3. The *R* and *L* opposite the figures for the diameter indicate whether the tap is right or left hand, while the *S* and *D* in the columns for the number of threads show whether the tap is single or double thread. The entry of an *S* for square or an *A* for Acme in the proper square thus tells the whole story about the tap recorded. Thus the *S* shows a ½-inch right-hand, eight-thread, single, square thread tap to be on hand, while the *A* shows a 9-16-inch, left-hand, nine-thread, double Acme thread tap.

▲ ▲ ▲

Organization Meeting of the International Association for Testing Materials.

This meeting has been called to convene at 7 P. M. June 16, 1898, at the Hall of the Engineers' Club of Philadelphia, 1122 Girard street.

The objects of this association are of such great importance to and so little understood by engineers that I would earnestly invite all members of the profession to attend this meeting and take part in the discussions. Participation in the meeting will no doubt add materially to the membership and advance the objects of the association.

GUS C. HENNING,
Member of Council, International Association for Testing Materials.

▲ ▲ ▲

In France they rotate a car wheel mold and first pour into it a hard steel, which is distributed by centrifugal force so as to form the face and flange of the wheel. Then they pour the rest of the mold with softer metal.

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A Discriminating Duty on Machinery That Should Be Removed.

As a result of negotiations which had been in progress for some time an arrangement was concluded recently between this and the French Government, under which certain articles largely exported by us to France and vice versa are admitted to the respective countries at reduced rates of duty. The principal American articles affected by the change are meat products and lard compounds. Machinery is not affected and the American duty on French champagnes is not reduced. The Dingley tariff act provides for a reduction of duty on champagnes provided corresponding concessions are made in our favor, and it seems to us that this affords a means of placing us on a more equal footing with Great Britain in the matter of exports of machinery to France. As our readers know, we are now sending considerable quantities of machinery to that country, but we might send more, and would be glad to do so.

At present the competition we meet there from British machinery builders is not serious, but it may become more so, and the first opportunity for removing the handicap which now exists and which is prejudicial to our machinery builders should be embraced.

As figures given in our issue May 27 last year show, British machinery sent to France pays a duty there of $40 per ton, while American machinery pays $60 when the weight is under one-quarter ton and for machinery weighing more than one-quarter ton the duties are $24 and $36 respectively. In other words a French importer of British machinery pays one-third less import duty than a French importer of American machinery. Of course Great Britain gives to France a corresponding advantage, and we have no reason to complain of discrimination against us, but our machinery manufacturers who have worked hard for their foreign business should not be handicapped in this way—nor in any other avoidable way.

If we are to do a foreign business we must, so far as possible, clear away all obstructions to it and we must especially see to it that our manufacturers are not handicapped by an advantage enjoyed by another nation, which advantage may go far toward offsetting the advantages secured by our constant efforts to reduce costs to the lowest possible figure. No more should be added to the cost of American machinery in France by the French duty than is added to that of British machinery. American machinery builders are certainly entitled to as much consideration in such a matter as are American sausage makers, and we shall hope that the reserved authority to lower the duty on champagne will be used for the purpose we have indicated.

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Urban Transportation.

Next in interest to the generation or conversion of energy is its application to the various uses of man, and as one of the most extensive and persistent of those uses is the traction of vehicles, especially for the conveyance of passengers, the problems involved in this connection and the records of progress toward their solution are always attractive to the engineer. The time is apparently not distant when the Borough of Manhattan will be able to say to the world—and probably will say it—that it has adopted and very completely installed a better system of traction for local surface cars than is to be found in any other of the great cities of our country or of the world. Those who have seen the underground trolley system as in operation in New York must readily concede its excellence. From the standpoint of the public it is an evident improvement over everything which has preceded it. Several long lines are already in operation under this system, and others will follow as soon as it is possible to complete the installation. The cable, which has had here its largest and best opportunity and has here made its best exhibit, will soon disappear, the necessity of a single system that will permit perfect freedom of transfer from line to line being imperative.

Now the underground trolley is certainly not the cheapest known system, either in construction, in operation or in maintenance; nevertheless it is soon to monopolize the great bulk of the surface traction of the island of Manhattan. The one and only fact which has secured the expenditure of many millions of dollars in the installation of the system here is that the powers that be have opposed, with a determination that seemed invincible, the admission of the overhead system. Manhattan would have been a worse tangle of overhead wires than its sister Borough of Brooklyn if the railroad people could have had their way. Notwithstanding the neatness, the general lack of annoying or objectionable features, and the satisfactory operation of the latest system, and the reverse as regards the overhead trolley, there is not the slightest prospect of the supercession of the latter by the former on the other side of the East River. By the simple operation of making the overhead trolley impossible of introduction a better system has been secured on the side where we write.

The question which now inevitably suggests itself is as to how long the present new system will hold. That it is the final solution of one of the great problems of civilization is not for a moment to be believed. In fact there is now in sight what we may easily believe is the edge of an entering wedge which may yet accomplish its overthrow. Simultaneously with the general adoption of the underground trolley in Manhattan, and in fact under the control of the same company, one cross-town line is to be fully equipped with cars operated by independent motors. The fact that the motors are to be driven by compressed air is of no significance in this connection. The one important condition which they will embody will be that the cars when running will be entirely independent of the track on which they run or of any outside connections for their motive power. A storage battery car would in this respect be under precisely the same conditions as the compressed air car. Either of them at once makes the slot in the street and all subterranean work superfluous and worthless. The independent motor car, of whatever type, also carries with it the ability to transfer from one line to another, as it can run upon any track

upon which any car can run, and on one track as well as on another.

The rapidly developing motor car seems to be already in a position to suggest the further question as to whether there is any necessity for the retention of the rail in our streets. The time is evidently not far distant when every principal street, certainly every street which will be a street car route, will be asphalted. No one can look upon a street car running along its rails, with the smooth and level asphalted surface on either side, without wondering why the car, with suitable wheels, might not run just as easily on the asphalt as on the steel. The independent motor, in its adoption upon one metropolitan line, asserts loudly that the slot is not needed in the street, and suggests also the question as to why our best streets are to be disfigured with the rail. The right of way, the right to compel other vehicles to keep out of the way can surely be enforced as well without the rails as with them.

The street car question is not to be argued exclusively or even principally upon the basis either of cost of installation or operation, or of power economy. The safest and most all around satisfaction of the wants of the public is paramount, and if this is purchasable, either by added cost or by sacrifice of power, the latter cuts a small figure in comparison with the results to be attained.

The surface traction problem is broadening rather than narrowing before us. We carry passengers through our streets better, safer, quicker and more numerously than ever before, but the final system to prevail is perhaps not even in sight, and the problem of light and heavy freight conveyances through our streets has not been touched. That in the end the horse will be as little thought of for the conveyance of the supplies to our houses and stores and factories and the products and refuse from them, as for the transportation of those who animate them, cannot well be doubted. The traction engine or its equivalent seems, more than anything just now, to await the practical inventor.

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Questions and Answers.

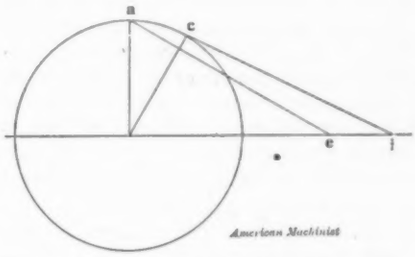
Name and address of writer must accompany every queston. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer questions by mail.

(60) I. A. T., Galt, Canada, asks: Can you give me a process for tinning a steel bowl about 5 inches diameter. There are some parts soldered inside, and if the bowl is dipped in molten tin they float away. A.—As the melting point of solder is considerably lower than that of tin the "floating away" of the parts is not surprising. If they were brazed on instead of soldered it would be possible to tin the bowl by the familiar process. Otherwise we can suggest nothing that will give a satisfactory covering of tin except electroplating. There are processes of so-called cold plating of iron with tin, but they give so thin a deposit as to be of no practical value.

(61) P. A., Jersey City, N. J., asks: What can I put in brass castings to prevent porousness? We have considerable difficulty in getting castings to hold air at high pressure, 250 pounds. Our mixture is 2 of copper to 10 of zinc, with a few ounces of lead. A.—The thing to add is a lot more copper. We have never known of so large a proportion of zinc being used. The heat at which the metal is poured makes a difference, and it should not be higher than is needed to make the metal flow freely. Castings are not required to be any less porous for compressed air than for water, so that sound castings are all that are required.

(62) H. E. T., Greenfield, Mass., writes: I have a worm gear to cut, and would like to know how far off center, per foot, to set the index to get the angle for the cutter, the worm being 2 inches diameter, 4 pitch. A.—We must assume in this case, although our correspondent does not tell us so, that 2 inches is the pitch diameter, and that by 4 pitch is meant 4 to the inch; 2 inches being the diameter, the circumference will be $2 \times 3.1416 = 6.2832$ inches, and ¼ inch will be the tangent of the angle of which 6.2832 inches is in this case the radius. The tangent of the same angle for a radius of 12 inches would then be 6.2832 : 12 : : .25 : .4774 inch, and this would be the distance per foot to set over. Then $.4774 \div 12 = .0398$, which is the tangent for radius 1, and the corresponding angle, from a table of tangents, is 2° 17′; or, according to the usual machine shop accuracy, a little less than 2 1-3 degrees.

(63) I. H. C., Omaha, Neb., asks: What is the relation of the maximum speed of a piston to the mean speed as usually stated? Is the relation constant, so that the same multiplier may be used for all ordinary cases? A.—Piston speed is usually stated as the product of double the length of the stroke by the number of crank revolutions per minute. Thus, at 50 revolutions per minute and 4 feet



stroke the piston speed would be said to be $4 \times 2 \times 50 = 400$ feet per minute. Now, the piston travels a distance equal to twice the diameter of the circle described by the center of the crank pin, while the pin itself, of course, travels the circumference of the circle. With a connecting rod of any length, or with a slotted crosshead or Scotch yoke, when the crank is at right angles to the line of piston movement the piston must travel at the same speed as the crank pin. The piston speed, then, in the case above cited would really be $4 \times 3.1416 \times 50 = 628.32$ feet per minute. Multiplying, therefore, the stroke and number of revolutions per minute by π, or 3.1416, will give the maximum piston speed with sufficient accuracy for any practical purpose. There is a little portion of the crank revolution where the piston actually travels faster than the crank pin, as anyone may readily convince himself by making the construction shown in the sketch, where the line *e i* is longer than the arc *a c*. The short connecting rod, of course, exaggerates the effect.

(64) D., St. Louis, sends us a blue print of a dog for driving the spindles of bevel gears from milling machine index heads, which we reproduce below in Fig. 1, and he desires to know if the device will space the teeth properly. It will be seen that the round tail of the dog is in line crosswise with the end of the shaft, and that it is free to move endwise in a slot carried by the index head. A.—The motion is correct at the point shown and

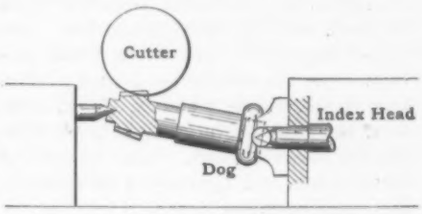


Fig. 1

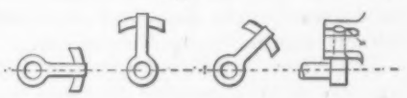


Fig. 2 Fig. 3 Fig. 4 Fig. 5

at points opposite and at right angles to it, but not at other points. That this is so can be seen from Figs. 2, 3 and 4, which show the slot and tail of the dog in three positions, the spindle of the index head being perpendicular to the paper. First imagine the pinion of Fig. 1 depressed until its shaft and the spindle of the index head are in line. In this position the index movement of the pinion will, of course, be correct, and if the replacing of the gear to the position of Fig. 1 causes movement about its axis such movement will represent an error in the indexing of the pinion. In the position of Fig. 2, first supposing the center lines of the gear and index spindles to be in line, it is clear that raising the end of the gear spindle nearest the observer will not disturb the indexing, because the tail of the dog will simply turn in the slot. Neither will the indexing be disturbed in Fig. 3, because the tail will slide bodily in the slot. In Fig. 4, however, such lifting of the pinion shaft tends to turn the tail downward, as seen more clearly in the side view, Fig. 5, and it is obvious that if such turning downward is not permitted by the slot, the pinion must turn on its axis and the correct spacing be destroyed. At small angles the error will be very slight, of course, but it is always there, and if a considerable angle were required on very accurate work it would be inadmissible.

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Machinery Wanted by the Navy Department.

The Navy Department is in the market for a large quantity of machinery and tools for the use of the navy yard at New York. Among the items required are the following: One 72-inch screw cutting lathe, one 37-inch screw cutting lathe, one 33-inch lathe, one 24-inch lathe, one 16-inch lathe, one 90-inch spur and worm

gear cutting machine, one self-acting planing machine, one self-acting planing machine, with one slide rest; one 72-inch hydrostatic press, one 16-inch double shaping machine, one turret head power bolt cutter, one universal radial drilling machine, one 50-inch vertical drilling machine, one 32-inch vertical drilling machine, one 24-inch vertical drilling machine, one keyway cutting machine, one two-spindle centering machine, two vertical sensitive drills, one vertical milling machine, one 14-inch lathe, one 21-inch swing drill, one automatic cut-off horizontal engine, one 100-kilowatt 125-volt generator, six two horse power, 110-volt inclosed, portable motors, two five horse power motors, two ten horse power motors, one twenty horse power motor, one 800-lb. single standard steam hammer, one No. 2 power shears, five top-braced hand cranes, one locomotive steam crane, and a variety of wood-working machinery.

All the above is to be delivered within sixty days after date of contract, and must be delivered at the New York navy yard without expense to the Government.

The Navy Department will open bids on June 28 for furnishing the above machines and tools. Information regarding the same can be obtained upon application to the Navy Pay Office in New York or to the Bureau of Supplies and Accounts, Navy Department, Washington.

A. F. T.

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Foreign News Notes.

The Bulgarian Minister of Public Works is receiving tenders up to July 10 next for the construction of a railway from Radonier to the Turkish frontier.

An important branch of Egyptian import trade is that of machinery. The cotton ginning industry is very extensive all over the country; nearly all gins used are of British make, as the American saw gin has not been successful in Egypt. There is a steady demand for pumping plants for irrigation purposes, consisting of centrifugal pumps of 36 and 40 inches diameter. Iron bridgework is being largely imported. The Egyptian customs administration has adopted the metric system of weights and measures.

The Swedish Rigsdag has authorized the construction of a railroad through the iron ore districts at a cost of $5,804,358.

The Chilian Congress, before its adjournment, passed a bill authorizing the expenditure of $220,000 in the extension of the existing railway systems and for the survey of new lines.

Japanese import trade is a matter of material moment. The imports of machinery for 1897 amounted to 12,291,037 yen as against a value of 6,209,276 yen in 1896. Those of locomotives, cars, etc., show an increase from 1,983,929 yen to 5,141,360 yen; of iron, from 2,359,704 to 3,046,131 yen, and of steel and iron rails, from 1,280,479 to 2,001,118 yen.

The London Underground Railway has placed an order for 8,000 horse-power Allis engines, a Babcock & Wilcox boiler plant, also a complete Barnard water cooling system, manufactured by the Wheeler Condenser & Engineering Company.

American firms have received orders for 200 engines for the Siberian railway.

The Australian Government has accepted the bid of the Pennsylvania & Maryland Steel Company for the supply of a quantity of rails and fish plates required for the railway department. Two American, one German and two British firms bid on the material. The British bids in lump sums were: 1. $394,904.16; 2. $385,271.64. The price at which the bid was obtained was $24.24 per ton for the rails and $45.58 per ton for the fish plates f. o. b. Melbourne. The total quantity to be delivered is 12,789 tons of rails and 1,250 tons of fish plates, to be delivered 3,505 tons in six, 3,510 in nine and the balance in twelve months from date of contract.

A. F. T.

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A Prospective Improvement in the Patent Office.

A ten years' fight for modern business methods in handling inventions in the Patent Office was culminated in the House of Representatives on June 6, when Representative Hicks, chairman of the Committee on Patents, secured the passage of his bill for revising and perfecting the classification of letters patent and printed publications in the Patent Office. For the past ten years the work of the Patent Office has been steadily falling in arrears, and business men and inventors throughout the country have deluged the office with complaints, but the officials were powerless to do anything, owing to the meager appropriations allowed by Congress. The bill as passed carries an annual appropriation of over $60,000 and provides for the employment of twenty additional examiners and assistant examiners. The measure has already passed the Senate and is now before the President for his approval. It is expected that it will become a law within a few days.

There is a provision in the bill which will be far reaching in its effect and will work a revolution in the methods now in vogue in the Patent Office. It is to the effect that for the purpose of determining with more readiness and accuracy the novelty of inventions, and to prevent the issuance of letters patent for inventions which are not new, the Commisioner is authorized to undertake the work of revising and perfecting the classification of patents and printed publications.

A. F. T.

Washington, June 8.

Charles E. Emery.

By the death of Mr. Charles E. Emery the engineering profession has lost a distinguished ornament, the country a valuable citizen and society a genial and delightful member.

Mr. Emery was in all respects a very superior man, and his sudden and entirely unlooked for death leaves a gap not easily to be filled.

He was a born engineer, which is something very different from a made engineer. He was devoted to his profession and excelled in it as few have done. The early portion of his career was passed in the navy as a member of its engineer corps, in which capacity he served with distinction during the war of the rebellion. He was as familiar with the practice or art of his profession as he was with its theory or science, and he knew how to supplement the one by the other with a judgment and skill that always made his work a pre-eminent success. His literary taste was fine, and his literary productions had the excellence that characterized all his efforts. He not only knew, but he knew how to tell what he knew—a rare gift in itself. His knowledge was of the most varied and extensive kind, and he could focus it all upon any subject under discussion.

The engineer corps of the navy at the time he was a member of it contained a large number of engineers, who, like him, afterward became distinguished in civil life. There was no such corps in the navy of any other nation, and its influence on the progress of engineering and nautical science has been enormous. Mr. Emery classed with the best of its members, and his untimely departure will be most deeply regretted by all his old colleagues; they regarded him not only with admiration as an engineer, but with affection as a friend.

I here speak from a lifelong knowledge of Mr. Emery, who, as regards length of years, ought in the usual course of nature, to have written an obituary for me. But all who knew Mr. Emery will agree with the writer's appreciation of his qualities. Nature had been as liberal to him physically as mentally. He was of fine stature, handsome countenance and elegant manners, an alert and experienced man of business as well as the accomplished engineering expert. It is sad to think that so much should have so untimely passed away.

B. F. Isherwood.

New York.

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Obituary.

Charles W. MacCord, Jr., died at Auburn, N. Y., on June 5, twenty-five years old. A son of the well-known professor of mechanical drawing at Stevens' Institute of Technology, the deceased graduated from that institution in 1894 with the degree of M. E. He at once became

assistant editor of "Power," contributing to that periodical several serial articles of value, his book on slide valves, published last year, having substantially originated in that way. For a year past he had been with McIntosh, Seymour & Co., engine builders, at Auburn, N. Y.

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An unmechanical looker-on has started on its rounds in the daily press a paragraph in which rock-drill runners are said to make their steam drills go by hammering them, just as a balking horse is stimulated by the whip, and some sort of intelligence is attributed to the drill in consequence of its response to the abusive treatment. It is a fact that in steam driven percussion rock-drills the valve sometimes sticks in the chest, and the drill also sometimes sticks in the hole, and then a blow or two, usually with the wrench, which is the runner's constant companion, will frequently start them again. It is also a fact that this practice probably causes more expense for repairing drills than any other thing. The most frequently repaired or renewed part of a drill is the valve chest, and it is upon this that the runner usually hammers, sometimes actually cracking the shell, and often by successive blows peening the chamber out of shape so that it becomes impossible for the valve to move.

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It is quite commonly believed by mechanics that the rate of expansion and contraction under changes of temperature is much greater in iron and steel than in stone and masonry, and it has been suggested that this fact should cause serious trouble in the modern high building. It is a providential coincidence that the difference is really very slight. The elongation of the familiar building materials from the freezing to the boiling point is given as follows, the length at the freezing point being,

Cast iron	1.0011
Wrought iron	1.0012
Marble	1.0011
Cement	1.0014
Sandstone	1.0017
Granite	1.0007
Brick	1.00055
Firebrick	1.0005

When fire occurs in a building the differences in expansion cause serious derangement, but even then the cause is mostly in the unequal heating of the different parts.

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The Chambersburg Engineering Company, of Chambersburg, Pa., has received an order for a hydraulic riveting plant to be erected in the Pittsburg Locomotive Works, which plant is one of the largest ever built. The riveter when complete will weigh 80,000 pounds, will stand 16 feet above and extend 9 feet below the floor line. They will also construct a 20-ton hydraulic crane for handling the work to be done by this riveter, the work being locomotive boilers of the largest and heaviest type.

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A correspondent of the "Globe," of London, expresses regret that something like £17,000 worth of new machinery to be used in the North Kent Iron Works will be purchased in America, the contract for the entire lot going to the Niles Tool Works, though we do not understand that all of it will be built at Hamilton. The contract includes a number of boring and turning mills which are referred to as "vertical lathes, not obtainable in England."

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We have received from Prof. W. F. M. Goss, of Purdue University, La Fayette, Ind., a pamphlet containing the announcements of courses in railway engineering and railway management for 1898-'9, in which is given a very complete account of what is included in the courses of study there, and in which, we believe, this school is the pioneer and leader. The work done in this department of Purdue has been very creditable to the school and to Professor Goss, who has charge of it, and it gives promise of continued progress and development.

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A rather curious use of a fan system for circulating air for drying was supplied some time ago by the Buffalo Forge Company to a Chicago confectionery firm for drying gum drops, and a carload of such gum drops, dried in this manner was recently shipped to London.

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At the recent convention of the American Foundrymen's Association, held at Cincinnati, the following officers were elected: President, C. S. Bell, Hillsboro, Ohio; secretary, John A. Penton, Detroit, Mich.; treasurer, Howard Evans, Philadelphia, Pa.

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Personal.

Charles L. Allen, of the Norton Emery Wheel Company, Worcester, sailed for Europe the 7th inst., to be gone about three months.

Gardner C. Sims, of Providence, R. I., has received a commission which promotes him to the rank of acting chief engineer, U. S. N.

Ambrose Swasey, of Warner & Swasey, Cleveland, sailed for Europe the 1st inst. Mrs. Swasey accompanies him, and they will spend the summer abroad.

Edward P. Thompson, mechanical engineer and solicitor of patents, formerly of Temple Court Building, has taken a suite of offices with his legal associate, Alfred C. Coursen, in the Market and Fulton Bank Building, corner Fulton and Gold streets, New York. Prof. Wm. A. Anthony is still associated with the firm.

Prof. O. P. Hood, of the Kansas State Agricultural College, has accepted a call to the chair of engineering of the Michigan College of Mines, Houghton, Mich.

D. E. McCarthy, who for the past two years has been foreman tool-maker with the Detroit Lubricator Company, is now employed in the Ordnance Department, Springfield Armory.

Prof. J. J. Flather has been appointed professor of Mechanical Engineering in the University of Minnesota at Minneapolis. For seven years past Prof. Flather has occupied a similar position at Purdue University, and has been an important factor in building up the enviable reputation and standing of that institution.

Mr. P. Thacher, who for two years has been salesman for the Carborundum Company, of Niagara Falls, has retired from that position. The Chicago office of the above named company (Monadnock Building) is now in the hands of Mr. Geo. R. Rayner, who was formerly secretary of the Hampden Corundum Wheel Company, of Springfield, Mass.

The following have been appointed assistant engineers in the United States Navy: Morris K. Davis, 1800 Broadway, San Francisco, Cal.; James R. Selfridge, 2615 California street, San Francisco, Cal.; David M. Berry, Mare Island, Cal.; Walter Kessler; Harvey Bates, Jr., 426 Produce Exchange, New York; Ellicott McConnell, 1434 Pine street, Philadelphia, Pa.; John F. Morris, Steelton, Pa.; Edward M. Jennings, Waterbury, Conn.; Thomas Rodgers, 5902 Baltimore avenue, Philadelphia, Pa.; Theodore Dimon, Ithaca, N. Y.; McCall Pate, naval station, Port Royal; Clifford G. Woolston, 239 Mount Pleasant avenue, Newark, N. J.; Warren H. Miller, Hoboken, N. J.; Charles H. Treat, Syracuse, N. Y.; Edwin G. Davis, Cambridge, Mass.

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Commercial Review.

NEW YORK, Saturday Evening, June 11, 1898.

THE MACHINE TOOL MARKET.

If there be taken into consideration the depressing influences of war and the fact that this season of the year might naturally show a little slackening in orders business must be pronounced as holding its own to a very satisfactory extent. At least several local indications are to that effect. Some indeed point to improvement as compared with the condition of things a few weeks since. For instance, a tool manufactory located in this vicinity has lately taken on twenty or twenty-five more men. Live concerns are certainly making ends meet nowadays and those of

moribund character would complain in the best of times.

A seller remarked yesterday that he believed the shortage of machine tools now to be such that manufacturers generally required two months time for delivery. This must not be taken as implying that stores are bare of stocks, but yet we know of some concerns that are sold out much more than two months in advance. For instance, we take the liberty to refer to a communication received this week from the Gleason Tool Company, Rochester, N. Y., mentioning that everything in its tool department is ordered five months ahead and that there is a most active inquiry for gears.

The prices of heavy machine tools are stated by companies handling those lines to have stiffened up somewhat of late. Without attempting to give any precise figures we judge from the reports that about 5 per cent. more would now be asked for heavy lathes, drill presses, planers, etc., than three or four weeks ago.

Tools are still being purchased for shops engaged upon Government work. The United States Projectile Company, Brooklyn, N. Y., has continued to add to its equipment, having lately made purchases from at least two concerns locally represented. They included some 22 and 24 inch lathes. The Taylor Iron & Steel Company, High Bridge, N. J., has also been buying more tools. The Builders' Iron Foundry, of Providence, R. I., which is reported to have received some good Government orders for projectiles, has installed an extensive addition to its machinery equipment.

Works are to be put in operation in the Central West for the manufacture of a quick-firing rifle, and the Niles Tool Works, New York, expect to furnish some $20,000 worth of medium sized machinery, made by the various companies they represent.

At the time of writing two Government contracts for machine tools are open to bidders. In addition to the very large one for the New York Navy Yard there is a rush order for machinery to be installed on board the United States ship Chicago, the bids upon which will be opened the 15th inst. The machinery comprises one 24-inch engine lathe, one 14-inch engine lathe, one upright back-geared drill press, one sensitive drill press, one 16-inch stroke shaper, one emery grinder, one 8 by 8-inch Greenfield vertical steam engine, some chucks, power transmission apparatus, etc.

The head of a local tool concern remarks good sales lately to electrical concerns and also to replace the equipment of manufacturing works that have burned down. About sixteen tools have just been sold for the latter purpose to a company located in this State. It was not considered desirable to give details.

EXPORTS OF MACHINERY.

Favorable reports concerning the export trade of this year continue to be heard in the New York market. This month will complete the first year during which exports of metal-working machinery have been separately mentioned in the statistics compiled in Washington. As soon as the report for next month appears, which will be some time in September, we shall have for the first time an exact means of comparing the monthly tool exports with those for the corresponding month of the previous year. It is a matter for lasting regret that the Government could not have foreseen the rise of the foreign demand for machine tools about a year before it began and have furnished from the start absolute and comparative data of that historic commercial movement.

According to the "Monthly Summary of Finance and Commerce" exports of metal working machinery for the month of April, 1898, amounted to $390,213, and for the ten months ending with April, $3,703,173. The figures for March have previously been reported—$451,855. Electrical machinery exports were: For April, $185,314; for the ten months, $1,702,812; for March, $243,578. Pumps and pumping machinery: For April, $160,246; for the ten months, $1,667,734; for March, $229,438. Shoe machinery: for April, $81,536; for the ten months, $722,274; for March, $77,661.

Exports of other lines of machinery, which having been separately classified for a longer time, permit of a more extended comparison, included: Locomotive engines, for April, 1898, 29 in number, valued at $191,764; April, 1897, 8, at $61,250; March, 1898, 68, at $530,748; ten months ending April, 1898, 366, at $2,983,082; ten months ending April, 1897, 278, at $2,616,528. The figures upon stationary engines were: For April, 1898, 44 in number, at $48,029; April, 1897, 82, at $44,351; March, 1898, 72, at $57,022; ten months ending April, 1898, 475, at $355,458; ten months ending April, 1897, 346, at $267,366. Upon boilers and parts of engines they were: For April, 1898, $46,986; April, 1897, $34,451; March, 1898, $103,825; ten months ending April, 1898, $726,470; ten months ending April, 1897, $593,600. Upon printing presses and parts thereof they were: For April, 1898, $68,915; April, 1897, $105,608; March, 1898, $85,284; ten months ending April, 1898, $762,945; ten months ending April, 1897, $541,257.

A company having offices in this city has shipped a notably large Universal boring and milling machine to Russia.

A company doing business in this market received this week an order for twelve or fourteen large tools for shipment to Germany. They comprise milling machines, boring mills, engine lathes, etc.

It is stated that the Ishikawajima Dock Company, Tokio, Japan, will erect workshops at an expense of nearly $500,000, and will require tools. American machinery will be considered. It is further affirmed that the engineering works at Yokohama, formerly owned by the Nippon Yusen Kaisha, have changed hands and that the equipment of machinery and tools will be enlarged.

If present predictions are fulfilled the American Chinese Development Company will construct in China an important railway line, the Canton-Hankow Railroad, and will purchase in this country from 150 to 200 locomotives, with 2,000 cars of all kinds.

PITTSBURG REPORT.

There is still the same backward tendency being experienced in nearly all lines of trade. New enterprises are being kept in the shade and many contemplated improvements are being held in check until a little better feeling prevails. It is the opinion of many that should Sampson or Schley secure a decisive victory over the Spanish forces at Santiago business in all lines would assume brisker conditions. At the present time nearly all the work being done is for Government use and the mills running on this work are going to their fullest capacity.

Pig iron production in this vicinity is keeping up with its regular figures. All but two of the furnaces are in blast. The crude lines, however, show no decided change since the last report, and can be said to be in a poor condition. Mills and foundries are running, but they could take on a great deal more work than they possess to-day. It will be remembered that the furnace operators of Cleveland and the Mahoning and Shenango valleys decided to shut down each one of the furnaces one-third of the time during the ninety days beginning May 1. By this action they desire to restrict the production

Continued on page 39.

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Business Specials.

Gear wheels, gear cutting. Grant; see page 18.

Forming Lathes. Mer. Mach. Tool Co., Meriden, Conn.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y.

Parallel drawing edge attachment; well made and finished, $1.25. F. G. Hobart, Beloit, Wis. Circulars.

Persons ambitious to understand all about link motion should send $1 to Loco. Engineering, 256 B'way, New York, for Halsey's Locomotive Link Motion.

Cutters, reamers and small tools, regular and special; vertical millers, cutter and surface grinders, shears and punches. R. M. Clough, Tolland, Conn.

Wants.

Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Situations Wanted.

Mech. draftsman, 8 years exp. Box 75, AM. MACH.

Mech. draftsman, G. W., care of A. Haas, 108 Av. A., N. Y.

Designer of steam, hydraulic and experimental machinery is open for engagement. Box 98 AM. MACH.

Wanted—Pos. as foreman of mach. shop; 12 years' experience as foreman; at present employed; for personal reasons desire a change; thoroughly famil'r with eng. work and job. Address Box 100, AM. MACH.

Situations Wanted—Cont'd.

Mech. draftsman, technical graduate, 8 years' all round exp. as machinist and draftsman in various shops, desires position. Box 96, AMERICAN MACHINIST.

Position as assistant to mech. eng'r by young man, exp. machinist, have technical training, one year's exp. in drawing room on tools and special mach.; references. Box 92, AMERICAN MACHINIST.

Mech., capable of design'g small tools, jigs and spec. machs., owner of several patents, would take charge of tool dept. or any machine shop; screw machines and monitors a specialty; 24 years' exp. Box 99, AM. MACH.

Wanted—A position by a foundryman, well qualified in the production of first-class work in any branch of the business with modern methods and appliances producing castings with economy in loam, dry sand and green sand molding, mixing and melting iron, brass and bronze, and in all the details concerned in the management of a modern foundry plant. Box 94, AMERICAN MACHINIST.

Help Wanted.

Agents in every shop to sell my line of tools; very liberal induc'm'nts. Address E. G. Smith, Columbia, Pa.

Wanted—A draftsman (in Ohio) who has had experience in engine work. Address stating experience, age, &c. Box 93, AMERICAN MACHINIST.

Wanted—A first-class machine draftsman; write and state experience and full particulars, also salary expected. Address S. L. Barriett, West Point Foundry, Cold Spring-on-Hudson, N. Y.

Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Best Calipers, Levels, etc. E. G. Smith, Columbia, Pa.

Book, Dies & Die Making, $1. J. L. Lucas, Prov., R. I.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co., Springfield, Mass.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Wanted—Some small machine to build by contract; A1 mechanics; new tools. Box 95, AM. MACHINIST.

For Sale—Second-hand drill presses, engine lathes and planers. Dietz, Schumacher & Boye, Cincinnati, O.

Wanted—A machine of latest construction for printing typewriter ribbons. Send full particulars with price to Box 97, AMERICAN MACHINIST.

Advertising Novelties Wanted—We will buy patents, manufacture for patentee or on a royalty, good advertising novelties Address P. O. Box 125, Erie, Pa.

Wanted—Good house to act as sole sales agency of a new agricultural machine; something practical and new; best of prospects. Address Box 69, AM. MACH.

The advertising department of the American Machinist has on hand 20,000 drafsman's thumb tacks; will send a box of ten to any draftsman in America on request; could use a postage stamp on box, but will send the tacks anyway.

Institutions retiring from business having machine tools, brass or wood working machinery, will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach Co., 55-59 Woodbridge st., W., Detroit, Mich.

The CROSS OIL FILTER

actually reduces oil bills 50% or more. Sent on approval. Capacities 3 to 120 gals. per day. Used in 18 countries. Testimonials from the leading firms in every field of industry.

THE BURT MFG. CO.
AKRON, OHIO, U. S. A.
Business Established 8 Years.
Largest Manufacturers of Oil Filters in the World.

FOR SALE.

A 10-inch Screw Cutting Lathe, compound rest, all screws graduated to 1-1000; for electrician or tool maker; countershaft and foot motion, chuck tools. Address W. E. C., 50 W. 96th st., New York.

MACHINE DESIGN,

Mech. Drawing, Mechanical and Elec. Engineering,

Taught at Your Home for $2 Per Month.

This pays for Text Books, Drawing Plates and Instruction until you complete the course. Write for free Circular T.

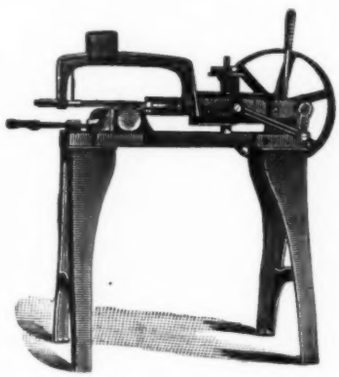
THE UNITED CORRESPONDENCE SCHOOLS,
F. W. Ewald, Gen. Mgr. 154-158 Fifth Ave., N. Y.

"The best is as good as any."

The New

Automatic and Gravity Feed

Q & C Shop Saw



Cuts { Tool Steel, Machinery Steel, Iron, Brass and All Other Metals.

Price—'Way Down.
Quality—'Way Up.

Shop Saws,
Portable Rail Saws,
Cold Power Saws,

For All Purposes.

Send for Catalogue.

Q & C Company,

Chicago. New York.

LONDON: Chas. Churchill & Co.
PARIS: Hounsfield & Fils.
BERLIN: Schuchardt & Schutte.
MADRID: J. G. Neville & Co.

Continued from page 38.

and make it comparatively easy to hold prices. So far this action has proved very satisfactory to themselves, as it has caused all the Pittsburg stocks of Bessemer to be eaten up, and now a price of $10.65 is demanded for the product in Pittsburg, occasioned by the scarcity of it.

As far as the machinery line is concerned there have been some contracts awarded lately, but they are not of large size. Plans are now being prepared by the Ohio Steel Company, of Youngstown, Ohio, for the erection of two blast furnaces. As yet no contracts have been awarded, but as soon as they are the work of erecting the buildings and installing the necessary power and pumping machinery will be done. Phillips & McLaren, of this city, whose plant was recently destroyed by fire, will rebuild same and place a lot of new machinery. The Monnessen (Pa.) plant of the National Tin Plate Company will be greatly enlarged. When this plant was first erected it was planned so that additions could be made any time.

The Westinghouse Electric & Manufacturing Company has been making shipments to all parts of the world. A late consignment was that of a 135 kilowatt single phase separately excited alternator to the Malaga Electric Company, Malaga, Spain. This company has made many large shipments lately and has its immense shops at East Pittsburg well filled with work.

CHICAGO MACHINERY MARKET.

Iron manufacturers have been busy during the past few weeks buying their material for the coming year's needs. The sellers of bars, sheets, plates, merchant steel and other mill products report that almost without exception the consumers are ordering either in the same sized lots as last year or in larger lots. This annual business is now pretty well out of the way, and the buyers have been fortunate enough to secure their material at very little advance over the low range of values of last year. It is regarded as somewhat remarkable that as yet the Western manufacturers have not begun to slacken the operations of their plants, save in exceptional instances. Indications are, therefore, that the summer suspension will be brief.

Selling agents of machinery, gifted with a sixth sense beyond the ken of the ordinary mortal, say they feel that in a few weeks business will take a change for the better. This belief serves to keep up their own spirits, if no further good purpose. Machinery trade for the present is dull. There are a few active spots, conspicuous by their rarity. The shops down in the stock yards' district, for example, are in a state of unusual activity, due to the large Government contracts which the big packers have accepted.

These shops have been taking quite a line of new machinery.

Special machinery is in better demand than the more ordinary tools. Vacuum machinery, used in sugar evaporation, for example, is finding a ready sale, not so much for sugar evaporation as for various other adaptations, where cheap evaporation is desired, as in soap factories, glucose works, etc., even to the degree where only 2 or 3 per cent. of the liquid is to be saved. The sugar evaporation machinery proper is meeting adverse conditions. The sugar interests in this country are more or less demoralized, in consequence of the possibilities of the annexation of the Hawaiian Islands, the Philippines and Cuba. But it is believed by the makers of machinery adaptable in those possessions that the annexation would be followed by the development of the resources of the islands to such a degree that heavy drafts would have to be made upon the machinery makers of this country, to an extent far beyond present or past demands.

The Walburn-Swenson Company shops at Chicago Heights are running full force. The company has just finished an order for fifty cotton compressors and has considerable work booked for the immediate future.

The E. P. Allis Company has just taken the contract for a 3,000 horse power vertical, direct connected engine for the Cleveland Electric Street Railway, the delivery to be made within six months. This builder has been compelled to decline some Mexican business last week, because the deliveries were wanted in seventy days, conditions that could not be accepted.

J. B. Doan reports business among the dealers of Chicago slow in May, but says he sold several large machines during the latter part, which pulled the month up above the average.

Kohler Brothers, representing the Northern Electric Manufacturing Company, report an excellent business, better in the country than in the city. Electrical installations in small plants throughout the West and Northwest, they say, are very numerous.

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Quotations.

NEW YORK, Monday, June 13.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$11 00 @ 11 50
No. 2 foundry, Northern	10 50 @ 11 00
No. 2 plain, Northern	10 00 @ 10 50
Gray forge, Northern	9 75 @ 10 00
No. 1 foundry, Southern	10 75 @ 11 00
No. 2 foundry, Southern	10 25 @ 10 50
No. 3 foundry, Southern	10 00 @ 10 25
No. 1 soft, Southern	10 75 @ 11 00
No. 2 soft, Southern	10 25 @ 10 50
Foundry forge, Southern	9 75 @ 10 00

A reduction in certain Southern irons is rumored. One of the chief firms engaged in that line of trade, however, denies the report.

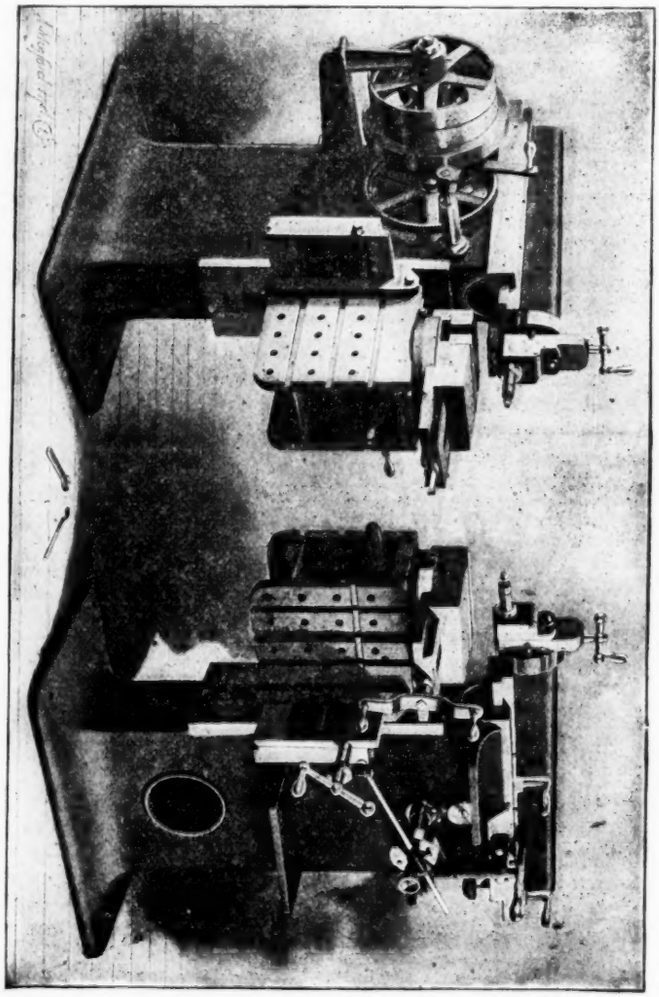
Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.05 @ 1.10c.; refined, 1.10 @ 1.20c. Store prices: Common, 1.25 @ 1.35c.; refined, 1.30 @ 1.50c.

Tool Steel—Base Sizes—Standard quality, 6 @ 7c., with some grades perhaps a little less; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Continued on page 41.

15-inch Pillar Shaper.

A FRICTION driven machine, fitted with a positive locking device for friction, insuring a uniform length of stroke under a heavy cut. Stroke can be changed to any position with ram in motion; has quick return; and our micrometer adjustment makes possible the most minute variation in length of stroke, which can be constantly varied with machine in motion; an especially valuable feature in tool and die work and in planing to irregular lines.



THE HENDEY MACHINE CO.,

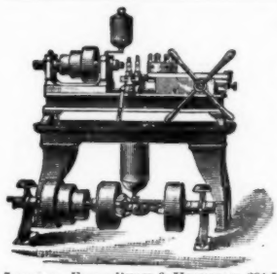
Torrington, Conn.

AGENTS FOR THE PACIFIC COAST:

PACIFIC TOOL AND SUPPLY CO., . . . San Francisco, Cal.
J. W. CREGAR, ... Philadelphia Bourse Exhibition.

EUROPEAN AGENTS:

SCHUCHARDT & SCHUTTE, Berlin, Vienna, Brussels, Stockholm.
CHAS. CHURCHILL & CO., Ltd., London and Birmingham, England.
ADOLPHE JANSSENS, ... Paris, France.



TURRET Head Machines and Tools for boring and facing hubs, pulleys and gears; for finishing keys and joints for gas fixtures, air cocks, electric apparatus, and for turning, forming and threading irregular pieces of circular cross section in brass, iron and steel. Movements of slides by hand lever, hand wheel, pinion and rack, or all automatic. The heads are often made with friction clutch back gears, to facilitate quick change of speed of spindle when light and heavy cuts are required on one piece.

ASK FOR THE MACHINISTS' CATALOGUE.

The Pratt & Whitney Co., HARTFORD, CONN., U. S. A.

London, Eng.: BUCK & HICKMAN, 281 Whitechapel Road.
Paris, France: FENWICK FRERES & Co., 21 Rue Martel.

New York: 123 Liberty Street.
Boston: 144 Pearl Street.
Chicago: 42 South Clinton Street.

THIRD EDITION. THIRD THOUSAND.

Kent's Mechanical Engineers' Pocket Book.

1,100 pages, 12mo., morocco flap, $5.00. Postpaid on receipt of price.

John Wiley & Sons, 53 E. 10th Street, New York City.

Finest Machine Relieved Taps and Adjustable Tap Wrenches

IN CASES.

SCREW PLATES, DIES, &C.

SEND FOR CATALOGUE.

WILEY & RUSSELL MFG. CO.,

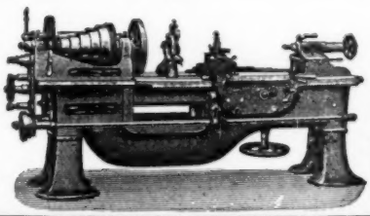
GREENFIELD, MASS., U. S. A.

MACHINIST'S SET—TAP WRENCH & TAPS
TAP WRENCH No. 4—19 IN. LONG AND MACHINE RELIEVED
TAPER, PLUG & BOTTOMING TAPS 3/8 TO 1 IN.—21 TAPS.
LIGHTNING

Agents in London, SELIG, SONNENTHAL & CO., 85 Queen Victoria Street.

PUTNAM MACHINE CO., The Oldest and Most Extensive Builders of Lathes in America.

LATHES, PLANERS, DRILLING MACHINERY, MILLING MACHINES, SLOTTERS, SHAPERS, GAP ENGINE LATHES.

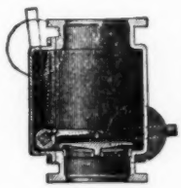


RAILROAD SHOP TOOLS, GAP PATTERN MAKERS' LATHES, &c.

Correspondence Solicited.

8 to 100 Putnam St.

Fitchburg, Mass., U. S. A.



Excelsior Straight-Way Back Pressure Valve.

This valve has no dash pots, springs, guides or complicated levers to get out of order. It is simple, reliable and well made. Never sticks, and can be relied upon at all times when using exhaust steam for heating; or when used as a relief, or free exhaust on a condensing plant, it has no equal. It is noiseless and free from any complicated attachments.

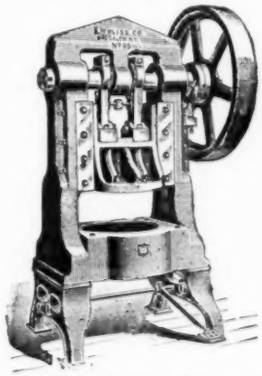
JENKINS BROTHERS, New York, Boston, Philadelphia, Chicago.

E. W. BLISS CO.

1 Adams St., Brooklyn, N. Y.

CHICAGO: 96 W. WASHINGTON ST.

European Office:
39 RUE CAUMARTIN, PARIS, FRANCE—A. WILZIN, Mgr.

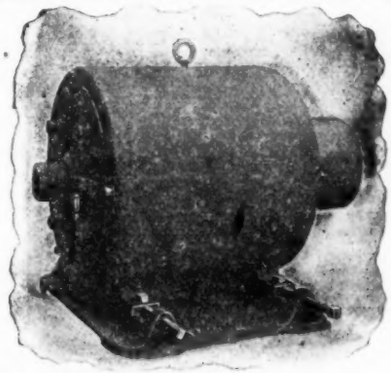


No. 95 1-2 "Bliss" Double Crank Press (Pat'd).

Owners of the Stiles & Parker Press Company.

Presses, Dies, Shears AND SPECIAL **Machinery.**

Manufacturers of the WALDRON FRICTION CLUTCHES.



The C & C Slow Speed Closed Ironclad Motor

is especially designed for hard service in mills and factories. Can be placed in any position and belted, direct connected or back-geared to its work.

Highly Efficient and Non-Sparking.

Complete Electric Power Transmission Systems.

The C & C Electric Company,

143 Liberty Street, New York.

Quotations Continued from page 40.

Machinery Steel—Ordinary brands, from store, in small lots, 1.45 @ 1.50.

Cold Rolled Steel Shafting—Base sizes, from store, 2.15 @ 2.20c., according to quantity.

Copper—Carload lots: Lake Superior ingot, 12c.; electrolytic, 11¾ @ 11⅞c.; casting copper, 11½ @ 11⅝c.

Pig Lead—Carload lots, 3.80c., f. o. b. New York.

Pig Tin—For 5 and 10 ton lots, 15.15c., f. o. b.

Spelter—Indefinitely higher. On retail lots 5c. has been bid, but the price in large quantities is hardly quotable above 4¾c.

Antimony—Hallett's, 9c.; Cookson's, 9½c.; United States, 8¾c.

Lard Oil—Prime city, present make, 52 @ 55c., according to brand and quantity.

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Manufacturers.

The Tennessee Coal & Iron Company, it is announced, will build a steel plant at Ensley City, Ala.

The Ball Bearing Company, Boston, Mass., is about to place a quantity of new special machinery.

The Balfour (N. C.) Manufacturing Company will soon install machinery to enable them to engage in knitting cotton goods.

The Latrobe Steel & Coupler Company, of Camden, N. J., with a capital of $300,000, has been licensed to do business in Illinois.

The entire plant, rolling mill and steel plant of the Burgess Steel & Iron Company, Portsmouth, Ohio, was recently destroyed by fire.

The Variety Machine Company, of Warsaw, N. Y., is erecting an addition to the plant, 100x40 feet, to be used as a planing mill.

The Shelby Steel Tube Company at Greenville, Pa., will double the capacity of its plant. About $200,000 will be spent in improvements.

The Chilson Furnace Company, of Mansfield, Mass., has been incorporated, J. W. White, president, and J. E. White, treasurer. Capital, $30,000.

Fire recently destroyed the foundry and factory of the Waterloo Wagonette Manufacturing Company, Waterloo, Ia. The damage was considerable.

The Friction Pulley & Machine Works, Sandy Hill, N. Y., is having a two story addition, 20x50 feet, built to its works, to be used for the electrical business of the Warren-Medbury Company.

The Brown Manufacturing Company, Zanesville, Ohio, is preparing to enlarge its plant considerably. The new building will be 160 feet long by 60 feet wide.

J. J. Voorhees, of No. 57 Duncan avenue, Jersey City, N. J., is to erect a two story brick rubber factory, 130x32, after plans by John T. Rowland, Jr., of the same place.

The Gregg Foundry & Iron Works, Trumansburg, N. Y., has been destroyed by fire. The main building was a total loss. The Morse Chain Company lost much of its valuable machinery.

The Boston Construction Company, Washington, D. C., has been incorporated. Its purpose is to manufacture building materials. The incorporators are Edwin B. Dow, Lewis Merriam and A. S. Parham.

The Clear Register & Manufacturing Company, with a capital stock of $25,000, has been incorporated at St. Louis, Mo. Chas. Clear, James Clear and Chas. Clear, Jr., are interested.

The contract for the erection of the silk mill to be built at Phoenixville, Pa., by Johnson Cowdin & Co., of Paterson, N. J., has been let to David Herny, of Paterson. The mill is to be 400 feet long, 150 feet wide and four stories high.

Norman H. Thatcher has the mason contract and Eustice Brothers have the carpenter contract for the building at East Orange, N. J., for the Crocker-Wheeler Electric Company, of No. 39 Cortlandt street, after plans by Gans S. Dunn.

The American Tool Works Company, of Cincinnati, Ohio, recently received orders for 22 and 24 inch lathes from the United States Projectile Company, of Brooklyn, N. Y. The demand for American machine tools in England is also reported to be steadily increasing, the London

SPENCER AUTOMATIC MACHINE SCREW CO. Now Located 111 SHELDON STREET, HARTFORD, CONN., U. S. A.

office of the American Tool Works Company having secured a number of orders there in the past two weeks.

The firm name of the Mackey Print Paper Company, Pittsburg, Pa., has been changed to that of the Mackey Company, Limited.

Epping, Carpenter & Co., Pittsburg, Pa., will erect a three story brick and iron pattern shop. One building will be 200x100 feet in size, the other 150x150 feet. The cost of both buildings will be $25,000.

The Carborundum Company, of Niagara Falls, N. Y., is about to enlarge its plant by adding a three story brick building, 50x228 feet. Mathieson Alkali Works, Niagara Falls, N. Y., is to enlarge its capacity.

Architect Charles McCaul, 10 North Eleventh street, Philadelphia, Pa., is taking estimates on alterations and additions to the iron foundry of Godfrey, Rebmann & Co. The plans call for brick and iron construction.

The Troy (N. Y.) Coal Tar & Chemical Company, whose plant was burned recently, has decided to rebuild its works on the same site. The plant will be enlarged and the latest improved machinery will be put in.

Jackson & Son, the contractors, Chester, Pa., are building a new addition to the foundry department of the Chester Steel Casting Company, Chester, Pa. It is expected that the building will be ready for occupancy in a short time, as work on the same will be rushed as rapidly as possible.

The Wilmot & Hobbs Manufacturing Company, of Bridgeport, Conn., are making additions to their manufacturing plant. These buildings are to be used as an engine and plating building and a machine or manufacturing building. The engine and plating building is about 60 feet wide and 100 feet long; two stories high. The machine building is about 80 feet long and 135 feet wide, and three stories high. The Berlin Iron Bridge Company, of East Berlin, Conn., is to furnish and erect the structural steel work.

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New Catalogs.

There are three sizes of Standard Catalogs, first authorized by the Master Car Builders' Association, 9" x 12", 6" x 9" and 3½" x 6". We recommend the 6" x 9" size for machinery catalogs. When they must be larger or smaller, one of the other standard sizes should be adopted if possible.

The Bickford Drill & Tool Company, Cincinnati, Ohio, has sent us 1898 catalog of machine tools, including radial drills, boring machines and mills. The catalog is standard size, 6x9 inches.

The Cushman Chuck Company, of Hartford, Conn., has sent us catalog of lathe and drill chucks, drill chuck arbors and other appliances used by those engaged in lathe work. The catalog is 4¾x7¼ inches.

We have received from the Bullock Electric Manufacturing Company, Cincinnati, Ohio, copy of catalog describing and illustrating various styles of motors adapted to the direct driving of machine tools, printing presses, line shafting, etc. The catalog is tastefully gotten up, and is standard size, 6x9 inches.

The American-Wheelock Engine Company, Worcester, Mass., has sent us catalog of the Greene-Wheelock engine fitted with the Hill valve gear. Illustrations of the various parts of the engine, particularly the valve motion, together with engines as installed for actual service, are given. The catalog is 8x10 inches, and will be mailed to those interested upon application.

KEUFFEL & ESSER CO.
NEW YORK.
127 FULTON STREET.
Branches 111 Madison St., Chicago.
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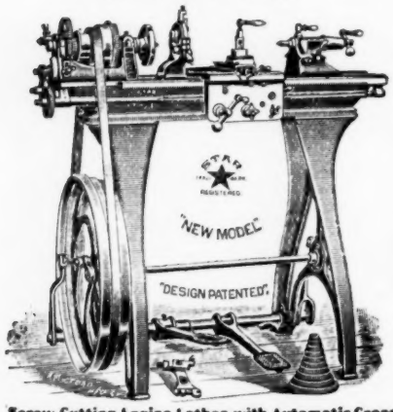

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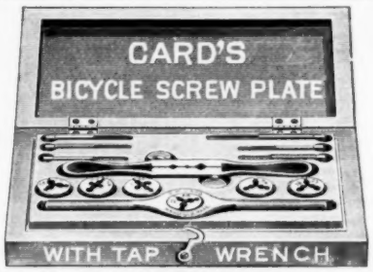

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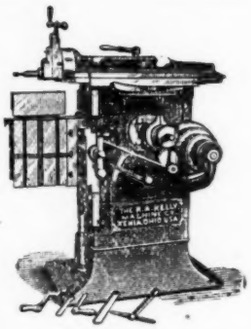

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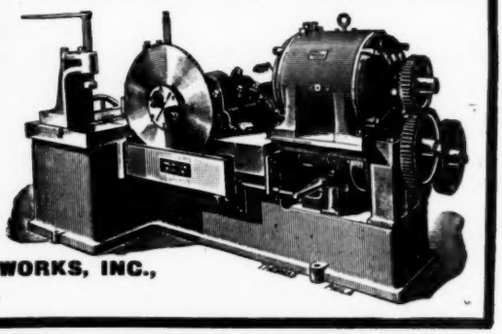

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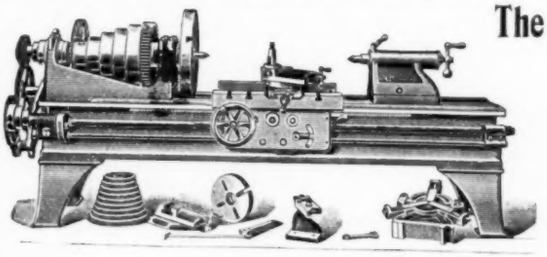

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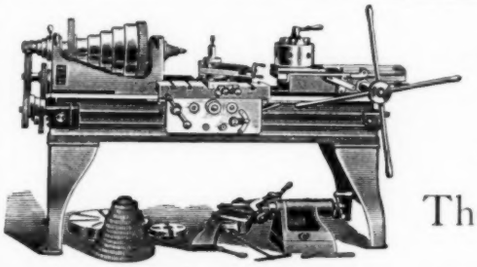

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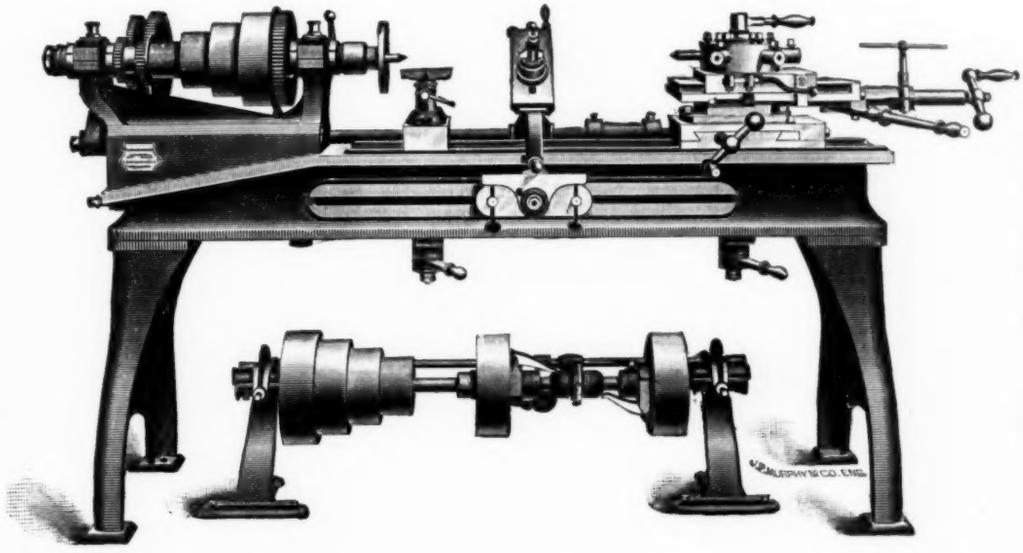

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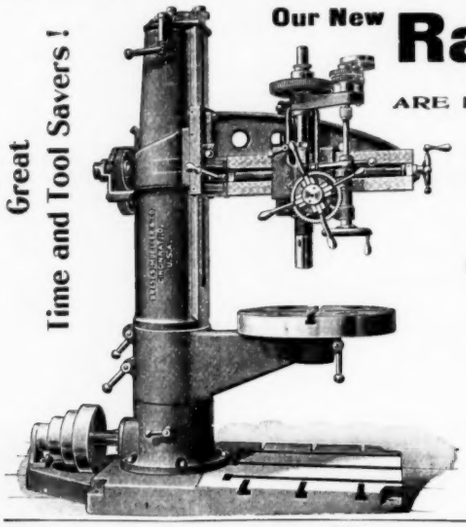

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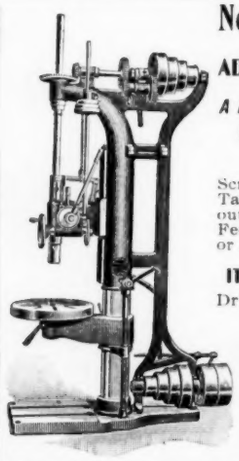

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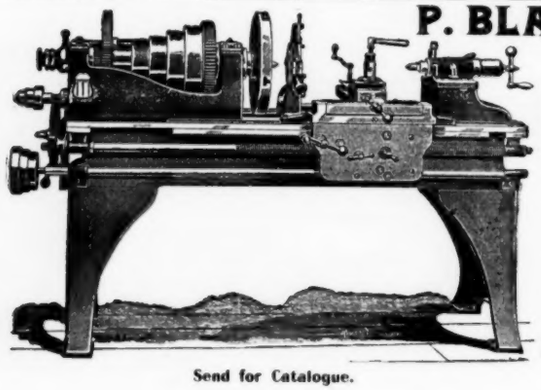

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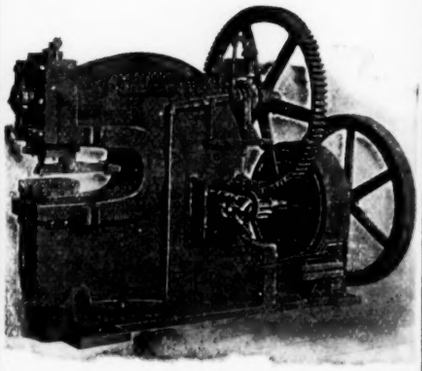

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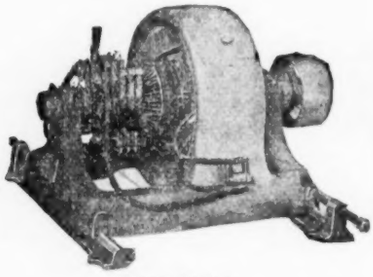

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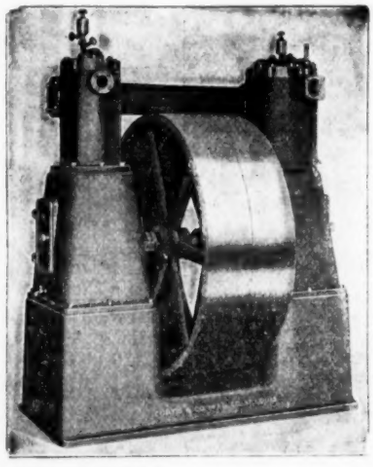

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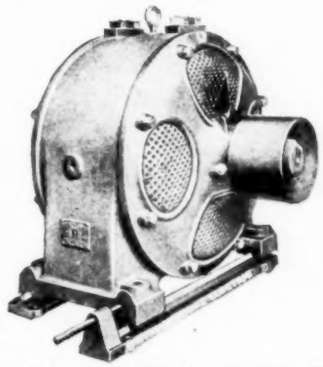

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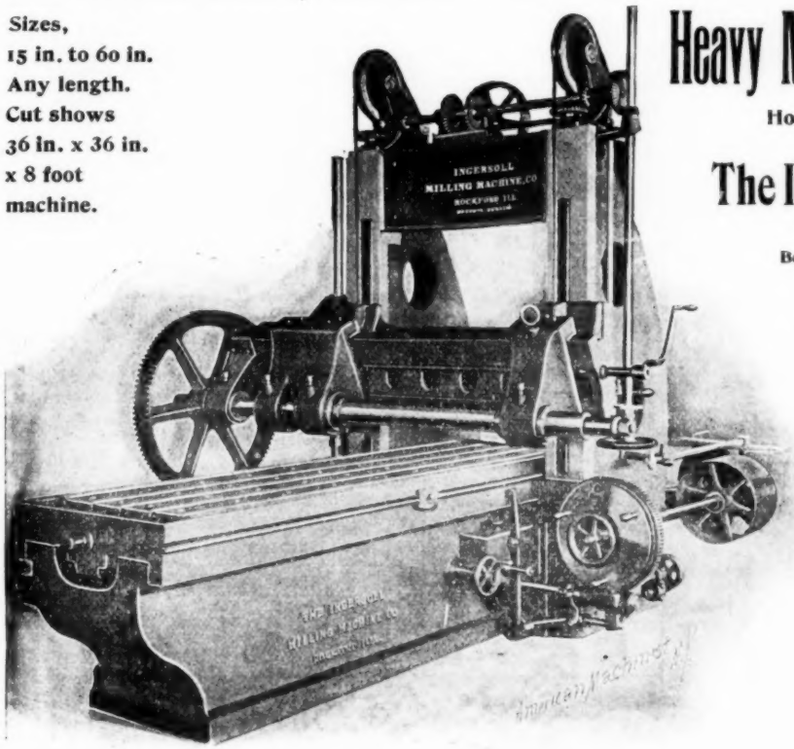

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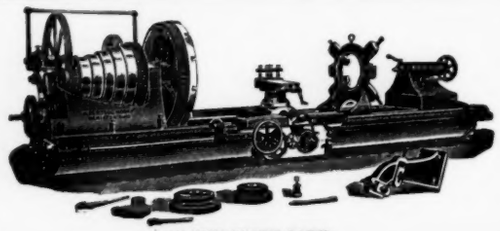

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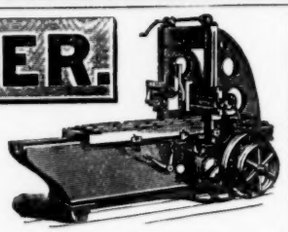

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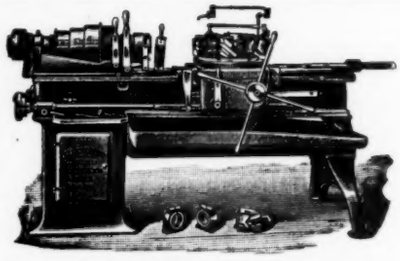

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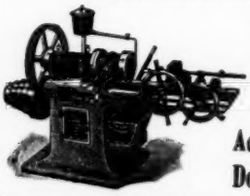

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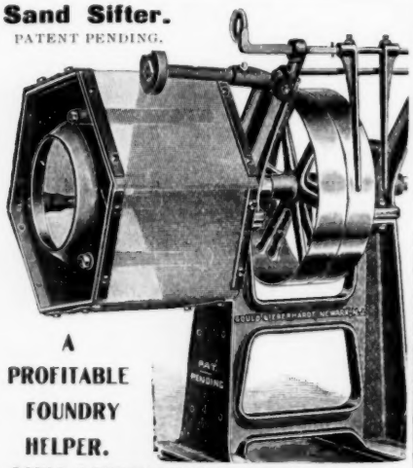

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